Engineering Library

ECEMBER 31
1932

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JAN 3 1933

ELECTRICAL WORLD

SOME
PPORTUNITIES
for 1933

IN THIS ISSUE:

nsportation uses 6,362,-0,000 kw.-hr. a year; it is oad worth retaining and lding. Page 892

habilitation of a hydro nt saves Southern Cali-nia Edison 50 per cent in erating costs and increased tput 14 per cent . . . re are similar opportuni-elsewhere. Page 876

at does the public want expect in lighting? . . . stinghouse sponsored a ey that ends conjecture. Page 887

istance welding is a great duction aid, but planned wer supply increases user utility satisfaction. Page 881

re's an example of space ngs . . . A 69-115-kv., line, 62,500-kva. switch-station on an area but 60 wide and 600 ft. long. Page 884

Good-by 1932

— — and good riddance

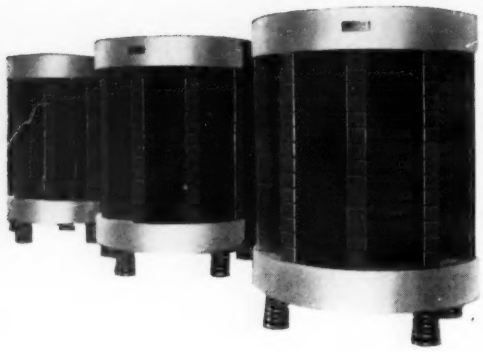
There was a lot of grief in your 366 days . . . We had to pay and pay for the ten years that went before . . . For the things that we didn't do, as well as the things that we did. . . . There are still some good-sized bills to be met . . . Some headaches yet to be lived.

But 1933 is here with all the promise and hope of a new year and of a fresh start

We're glad to see it . . . And if we make resolutions conscientiously, and break them, at least we know what some of them ought to be . . . They're old fashioned. . . . They have to do with Honesty — and Thrift — and the Square Deal — and Hard Work — and the Long Pull — and they put Something for Nothing and Lady Luck right where they belong.

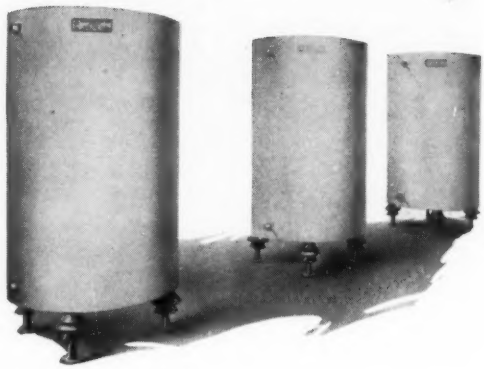
In our January 7, 1933, issue we have analyzed the markets ahead of the electrical industry, the opportunities for business and service for utility and manufacturer.

Welcome 1933



LEFT:

1336 K.V.A., 4060 Ampere, 11.4 K.V., 25 cycle indoor service, open type, fireproof construction.



ABOVE

277 K.V.A., 600 Ampere, 16 K.V., 50 cycle outdoor service, dry type, all enclosed reactors.

MURRAY Low Loss* Reactors

Reactors are supplied for all kinds of services.

Dry type reactors for line voltages up to 33 K.V. for indoor or outdoor installation, — as large as 5000 amperes, as small as .4 K.V.A.

Special reactors for testing purposes, for starting, for transformer balancing, or shunt reactors are also made.

When in need of reactor protection send us your inquiries. Efficiencies guaranteed.

METROPOLITAN DEVICE CORPORATION

1250 ATLANTIC AVENUE

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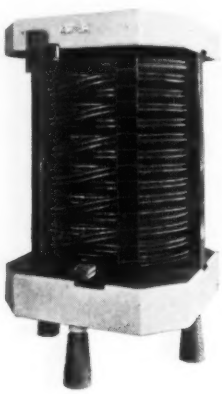
SINCE 1899

*Trade Mark Registered.

BELOW

1125 K.V.A., 3000 Ampere, 12 K.V., 60 cycle indoor service, open type, fireproof construction, special design to meet customer's space allotment.

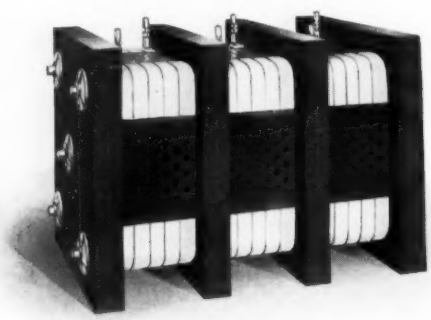


ABOVE

Special fuse testing reactor. Maximum short time rating 3000 Ampere, 12 K.V., 60 cycle, 6 tap variable reactance.

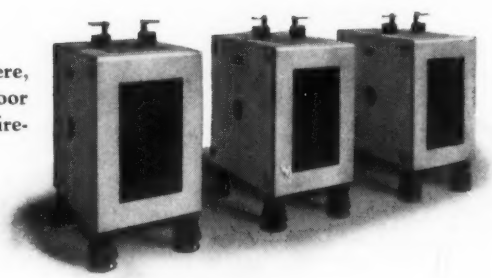
BELOW

36 K.V.A., 100 Ampere, 4.15 K.V., 60 cycle, 3 phase indoor service, enclosed type, fireproof construction.



RIGHT

162 K.V.A., 500 Ampere, 6.6 K.V., 25 cycle indoor service, enclosed type, fireproof construction.



ELECTRICAL WORLD

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for the Week Ending

December 31, 1932

Insull Free; Extradition Refused

IN THE opinion of five judges of the Athens Court of Appeals the charges against Samuel Insull, under which he has been held by Greek authority at the request of the United States, are those regarding crimes which have not been proved. Their decision is that Mr. Insull is not therefore subject to extradition to this country. All of which presents an extraordinary situation. After eleven weeks of carefully planned moves the United States government apparently finds itself unable to secure the effectiveness of a consummated extradition treaty. The rejection of the petition for extradition is final.

The next move appears to be Mr. Insull's. When reminded several days ago that his passport is understood to expire on January 7, and questioned as to his intention of remaining in Greece indefinitely, he is reported to have said "Why not? I like living here." On the other hand, it may be recalled that Mr. Insull, somewhat evasively it is true, previously indicated his willingness to return when the political situation and, presumably, heat of local feeling subsided.

Prospects that the Insull utility situation will continue to occupy the attention of the courts in this country during the coming year seem certain now with the various protective committees actively urging the recognition of their rights. In addition to the recent action taken by Lewis E. Jacobson, counsel for creditors of Insull Utility Investments, Inc., in questioning the pledging of assets for loans with five leading New York banks (ELECTRICAL WORLD, December 24, page 834) a committee, representing holders of $40,000,000 of Middle West Utilities notes, has indicated that a suit will be brought to recover $8,302,947 of pledged collateral, basing its claim on the provision in the bankruptcy act that all special collateral given within four months of the date of a receivership must be held for the benefit of the general creditors.

Another group of Insull investors aired their grievances when George W. McGhie, Jr., acting as secretary of a serial gold note holders committee and in his own behalf as a holder of $5,000 worth of notes of the Corporation Securities Company, an Insull unit, began suit last week in federal court in New York to recover securities valued last April at $3,895,000. The securities, put up as collateral for loans totaling $5,000,000, are held by the Central Hanover Bank & Trust Company, the Chase National Bank and the Guaranty Trust Company of New York.

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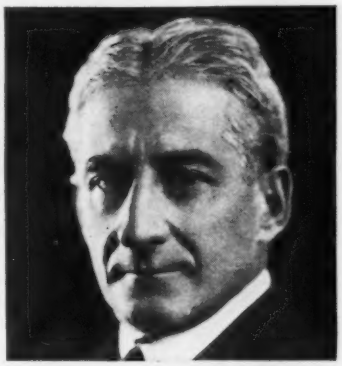

The effort of industry is to produce the things that are necessary or desired with the least expenditure of time and effort, and to distribute its product at the lowest possible cost. Industry, therefore, is primarily for service to the community and not primarily for the aggrandizement of the individual either in power or profit.

GERARD SWOPE
President
General Electric Company

[Mr. Swope took a markedly advanced viewpoint in discussing the fundamentals of "Employment: Assurance and Insurance" before the American Association for the Advancement of Science this week and urged planned action and facts on which to base accomplishment]

John J. Carty Succumbs Following Operation

Brig.-Gen. John J. Carty, retired vice-president and chief engineer of the American Telephone & Telegraph Company, died December 27 in Johns Hopkins Hospital of cardiac complications that followed an operation. He was 71 years of age. Telephone pioneer and inventor, General Carty was responsible for many important developments in the fields of telephonic, telegraphic and radio communication.

His most notable achievement as chief engineer of the American Telephone & Telegraph Company was the completion in 1915 of the transcontinental telephone line which made possible the first transmission of speech between the Atlantic and Pacific Coasts and led to the extension of nation-wide telephone service. Transcontinental telephone service was followed quickly by the first successful transmission of speech by radio-telephone, marking the pioneer efforts in the development of a radio-telephone system practically world-wide in its reach. A past-president of the American Institute of Electrical Engineers, General Carty had been the recipient of many honors in the course of his long and distinguished career.

▼

Edwin M. Herr Dies After Long Illness

Edwin Musser Herr, vice-chairman of the Westinghouse Electric & Manufacturing Company since 1929 and an outstanding figure in the electrical manufacturing industry for a number of years, died December 24, at his home

in New York, after a long illness. He was 72 years of age. Before becoming vice-chairman Mr. Herr held executive positions in the Westinghouse corporation since 1905 and had served with Westinghouse companies since George Westinghouse asked him in 1898 to become general manager of the Westinghouse Air Brake Company. He was president of the Westinghouse Electric & Manufacturing Company from 1911 to 1929, in which period the company's annual business grew from $20,000,000 to approximately $200,000,000.

▼

"Electric Dollars" Urged at Science Meeting as Monetary Panacea for the Nation

STEALING a march on the technocrats who have similar ideas to spring but have hitherto contented themselves with energy-money generalizations, Dr. John Pease Norton told the joint session of the economic section of the American Association for the Advancement of Science and of the Econometric Society this week of a new "electric dollar" which might be measured in terms of kilowatt-hours and revalued every five years. This monetary unit, which he proposed, was described, in part, by Dr. Norton as follows:

The present bond-secured bank notes arise by banks depositing gold bonds (the specified government issues) with the United States Treasury, against which bank notes are issued to the banks and pass into the monetary circulation. Government bonds are futures in gold, a promise by the government to pay gold at a future date.

In a similar way the electric light companies would deposit with the United States Treasury futures in kilowatt-hours, i.e., their promise to deliver kilowatt-hours in the future to an amount fixed in certain manner, against which the United States Treasury would deliver "electric dollars." The bond held by the government for performance of the ultimate redemption would be a lien ahead of all obligations on the property of the electrical corporations.

Overlooking a few fundamentals

The "electric dollars" would go to the electrical companies instead of to the banks, as now, to be paid out in wages, dividends and in payment of supplies, everywhere in the general circulation, just as banknote currency is paid out by the banks. Banks would keep checking accounts in electric dollars and the gold paper substitutes would be retired gradually.

Long-term contracts longer than five years could be made in "Edison dollars" or in gold dollars, at the option of the parties. Gold currency would fluctuate in price with reference to the electric currency standard, just as foreign exchange rates do now. The electric dollar would not fluctuate, inasmuch as it would be the country's legal standard of value.

The "Edison dollar" could be made stable in purchasing power. Stability of value would be measured by the standard deviation of the average of prices of commodities expressed in the electric standard. If the United States Treasury is directed along the lines of the Goldsborough bill to maintain the index number at a given level, it is simply necessary to declare, when the index number rises in the electric dollar standard, a proportionate contraction in the volume of currency, thereby restoring the average price level.

The permissible unit of fluctuation might be 2 per cent of the daily index number, at which expansion or contraction of currency could be ordered as needed. This is a responsive system, since all "electric dollar" currency in a short time could be extinguished by payment of customers' bills to the electric companies.

Dr. Norton suggested a definition of the electric dollar as 40 kw.-hr., valuing the average kilowatt-hour at 2½ cents.

▼

South Carolina Utilities Stick by Offer

Notifying South Carolina's Railroad Commission that they could not make rate reductions conditionally proposed for their territory without acceptance of those conditions, Duke Power Company and Southern Public Utilities Company, a subsidiary, have rejected the commission's qualified approval

▼

IRVING LANGMUIR ACCEPTS THE NOBEL PRIZE

Wide World

Surrounded by royalty, Dr. Irving Langmuir, associate director of the General Electric Research Laboratory, received the Nobel Prize from the hands of King Gustaf of Sweden ("Electrical World," December 10, page 799). The presentation took place in Stockholm and was made in recognition of Dr. Langmuir's achievements in chemistry. He has been quite as well known in the strictly electrical field with many important developments in electrical lamps, gas-filled tubes and welding to his credit.

(ELECTRICAL WORLD, December 24, 1932, page 840). The commission's objection to the companies' offer is based on the contention that while the proposal does provide lower rates in some instances it would mean an increase in others. Continuance of its investigation was stipulated.

▼

New York Mayors Urge Extended Utility Control

After making a study of utility regulation, a committee of the New York State Conference of Mayors has recommended that not less than 50 per cent or more than 75 per cent of the expense of investigation, rate proceedings and valuations made by the Public Service Commission should be paid by the public utility companies. The report urges the state to make appropriations so that the Public Service Commission may equip its bureau of valuation to make appraisals of utility property for rate-making and regulation purposes. It calls for extension of commission power to cover both operating and holding companies.

Among other changes suggested are "that the commission have power and be authorized to investigate and subpœna the officers, employees, books, documents and records of any person, firm or corporation which furnished to any public utility in the state any management, auditing, purchasing, engineering or construction service," and "that the commission have increased power to investigate and regulate the operations, issuance of securities, practices of all holding companies which control directly or indirectly any public utility operating companies within the state of New York."

Must Well-Wishers Destroy Us?

As though motivated by a common and irrepressible urge at the happy prospect of seeing an end of this much-to-be-lamented year, business leaders, economists, professors, bankers, politicians and nobodies have sprung forward with a new crop of panaceas and cures ranging from revolution, tariff revision, let-the-government-do-it and "electric dollars" to get-religion injunctions.

One might well hark back through the centuries to the Marshal de Villars and his anguished cry of "God save me from my friends, I can protect myself from my enemies."

It is notable that scarcely a murmur is heard, in the vast babble of well-meant advice, which would counsel accepting things as they are and fighting through by facing facts instead of evading them. HOW TO ESCAPE paying for the social-economic madness of the past ten years and NOT HOW TO PAY is the desperately eager quest. There is a mighty good likelihood that it would be better to pay and have it over with; that it would have been better one year ago, or even two years ago, to pay and have done.

Most generally acclaimed of the events of the week was the passing, by the House of Representatives, of the bill to legalize 4 per cent beer. The prospect of drinking the way back to prosperity has a wonderful popular appeal, however illusory it may be as a practical means to restore purchasing power.

Commodity prices have again declined sharply, reaching, on general averages, new lows for the whole depression period. Farm products are notably weak. The possibilities of a rally shortly after the first of the year are foreseen as reasonable by some observers.

That coal production for the week ended December 17 was 10 per cent above that in 1931, coupled with sustained strength in energy production and reasonable resistance to decline in car loadings, is encouraging, but trade volumes for the last few weeks of the year are too diversely affected to warrant conclusions.

Electrical manufacturing in November, as reflected in "Electrical World" energy use reports, stood 5 per cent above October and 20 per cent above August's lows.

▼

Wholesalers' Trade Rules Approved by Federal Trade Commission

TRADE practice conference rules adopted by the electrical wholesalers' industry at a meeting held recently in Cincinnati, under the direction of Commissioner Charles H. March of the Federal Trade Commission, assisted by M. Markham Flannery, Director of Trade Practice Conferences, have been approved by the Federal Trade Commission. The twelve rules, approved by the commission and designated as Group 1, pertain to unfair methods of competition, while the remaining rules, designated as Group 2, are accepted by the commission as expressions of the trade.

The rules approved by the commission relate to such practices as false advertising, inducing breach of contract, defamation of competitors, selling goods below cost, price discrimination, giving money or anything of value to customers of competitors without knowledge of their employers, secret payment of rebates, enticing employees of competitors with the purpose of unduly hampering them in their business, obtaining by false statements information from competitors concerning their business, shipping goods on consignment with the intent and effect of injuring a competitor, distributing electrical supplies not properly identified and acceptance of orders for large quantities of products, then making small deliveries at quantity prices.

Price discriminations hit

In connection with price discrimination the official Trade Commission statement says: "It is unfair trade practice for any person engaged in interstate commerce, in the course of such commerce, either directly or indirectly, to discriminate in price between different purchasers of commodities, where the effect of such discrimination may be to substantially lessen competition or tend to create a monopoly in any line of commerce; provided that nothing herein contained shall prevent discrimination in price between purchasers of the same class on account of differences in the grade, quality or quantity of the commodity sold, or that makes only due allowance for differences in the cost of selling or transportation, or discrimination in price in the same or different communities made in good faith to meet competition, and provided, further, that nothing herein contained shall prevent persons engaged in selling the products of this industry in commerce from selecting their own customers in bona fide transactions and not in restraint of trade."

Rebates ruled unfair

The rule on the payment of rebates states: "The secret payment or allowance of rebates, refunds, commissions, or unearned discounts, whether in the form of money or otherwise, or secretly extending to certain purchasers special services or privileges not extended to all purchasers, under like terms and conditions, with the intent and with the effect of injuring a competitor and where the effect may be to substantially lessen competition or tend to create a monopoly or to unreasonably restrain trade, is an unfair trade practice."

Group 2 rules, accepted as expressions of the trade, have to do with such subjects as shipping unlabeled products, thus making possible easy substitution of low grade materials; repudiation of contracts; accurate cost finding; publishing price lists; dissemination of statistical information, and the like.

A committee on trade practices was created to co-operate with the Federal Trade Commission and to put these rules into effect.

Coming Meetings

American Engineering Council—Washington, D. C. Jan. 15. L. W. Wallace, 774 Jackson Place, Washington, D. C.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 23-27. H. H. Henline, 33 West 39th Street, New York.

Great Lakes Division, N.E.L.A.—Fifth annual sales conference, Chicago, Feb. 16-17. T. C. Polk, 20 No. Wacker Drive, Chicago.

National Accounting Section, N.E.L.A. Committee meetings, Chicago. Feb. 20-21. A. J. Marshall, 420 Lexington Ave., New York.

New England Division, N.E.L.A.—Engineering Section, Boston, Mass. March 2-3. O. A. Bursiel, 20 Providence St., Boston.

Oklahoma Utilities Association — Oklahoma City, Okla. March 7-8. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City, Okla.

National Sales Section, N.E.L.A.—Committee meetings, Chicago. March 21-23. A. J. Marshall, 420 Lexington Ave., New York.

▼

Portland Utility Quandary Approaches Solution

Restitution of the preferred stocks of Pacific Northwest Public Service Company, Portland, Ore., to all local investors who traded these stocks for the preferred issue of Central Public Service Corporation, its parent company, or who bought Central Public Service preferred for cash (ELECTRICAL WORLD, October 8, page 485, and November 12, page 644) is promised through a deal just consummated by Franklin T. Griffith, president of Pacific Northwest Public Service, with A. E. Peirce, president of Central Public Service Corporation. In this deal Seattle Gas Company, the common stock of which was formerly owned by Pacific Northwest Public Service, passes to Consolidated Electric & Gas Company, another company affiliated with Central Public Service. At the same time absolute management of the Northwest Company passes to local people through the resignation from the directorate of Pacific Northwest Public Service of Mr. Peirce and his associates in Chicago, who will be replaced by local men, and through the deposit of all Pacific Northwest Public Service common stock owned by Central Public Service Corporation in a voting trust to be administered by a local committee.

Coincident with this announcement, which was received most favorably by local stockholders and customers of Portland General Electric and Portland Traction Company, subsidiaries of Pacific Northwest Public Service Company, was the announcement that a loan had been secured from the Chase National Bank, New York, for retirement on maturity January 1, 1933, of $7,500,000 short-term gold notes of Portland General Electric Company.

Some thirty suits alleging fraud and misrepresentation in the original exchange of stock have been filed against the local company and Central Public Service, and several attorneys representing these litigants have signified their intention to advise their clients to dismiss their suits and accept the preferred exchange.

▼

Accounting Practice Inquiry Ordered for Los Angeles

Investigation into the accounting practices of Los Angeles Gas & Electric Corporation has been ordered by the California Railroad Commission, which plans to devote particular attention to the company's policy of handling additions to capital. Hearing on the order will begin January 11, 1933, before William J. Carr, commissioner, in Los Angeles. The company has been ordered to show cause why its 1930 and 1931 reports should not be revised.

The commission's order declares that the company's fixed capital was written up to the extent of $4,900,000 in 1930 by increasing the amount of construction overhead applicable to the years 1913-1929, inclusive, and that as a result surplus was increased some $3,500,000.

▼

Union Electric Appeal Heard in Missouri Court

Appeal of the Union Electric Light & Power Company of St. Louis from the ruling made last April by the state Public Service Commission (ELECTRICAL WORLD, April 16, page 676, and May 7, page 802) denying the company authority to acquire and hold voting trust certificates on 3,333 shares of the common stock of the Laclede Power & Light Company, was argued last week in the Cole County Circuit Court before Judge W. S. Stillwell.

Theodore Rassieur, general counsel for the Union Electric, in his argument in support of the appeal from the ruling, said the company is making the effort to hold the voting trust certificates in good faith, and that to do so would result in benefit to the public. It was the purpose of the company ultimately, if permitted to hold certificates, to take over the Laclede Power & Light Company. There was no motive in the plan to harass or embarrass that company, he testified.

General Counsel D. D. McDonald, representing the state Public Service Commission, said the commission refused to grant authority to the Union Electric to hold the certificates for the reason it was deemed deterimental to the public. There was not a single fact in the record of the case that would show the public would benefit by the granting of such authority, outside of the opinion expressed by President Louis H. Egan of the Union organization, when he testified in the hearing before the commission.

Col. Bennett C. Clark of the Laclede Power & Light Company charged the Union Electric with acting illegally in acquiring the voting certificates without first having obtained the consent of the commission. Judge Stillwell took the case under advisement.

▼

Utility Law Changes Asked by Pennsylvania Board

Three important amendments to the Pennsylvania public service company law have been suggested to the special Senate investigating committee in a letter signed by the entire membership of the Pennsylvania Public Service Commission. The recommendations include amendatory provisions giving the commission control over all contracts and all financial relations between each and every utility operating in the state of Pennsylvania and any holding company, affiliated company or any other company; provision that securities of the utilities shall not be issued until after the commission shall have reasonable opportunity to approve or disapprove, and forbidding security issues disapproved by the commission and provisions enabling the commission upon application or upon its own motion to suspend and set aside until further order pending investigation any increase in rates or changes in the rules and regulations of any utility company.

The letter stated that later the commission will send other suggestions, covering "such matters as legislation that will enable the commission to award reparations promptly upon determination that rates have been unreasonable and to do so without compelling each consumer to file a petition for reparation; power to unify the transportation facilities of the commonwealth; legislation that will enable the commission to control more definitely the amount of penalties, ready-to-serve charges, disconnection of service, and extension of service to sparsely settled areas; legislation having to do with rates and charges, and the power of municipalities to acquire and operate their utility service, especially water service. . . . At the same time we suggest that the best interests of the public might be conserved through the joint consideration of this legislation by representatives of your committee, of the Department of Justice and of the Public Service Commission in order that such legislation as can thus be agreed upon can be put into shape satisfactorily to the three parties."

No important developments occurred during the week in the injunction pro-

ceedings, which have halted the investigation of the special Senate investigating committee, aside from the committee's being promised prompt decision by the Dauphin County Court. The committee has already appealed to the Supreme Court from the temporary writ, but the higher court refused to entertain the appeal until the lower court acted finally.

▼

North American L. & P. Votes Stock Write-Down

At a special meeting the stockholders of North American Light & Power Company have approved a reduction in the stated value of the common stock to $5 a share from $23.59 a share, in accordance with the plan submitted by the board of directors (ELECTRICAL WORLD, November 26, page 706), and voted to retire 8,820 shares of preferred stock and 108,339 of common stock previously purchased in the open market by a wholly owned subsidiary. The stated value of the common stock will be reduced $35,838,098 and the number of outstanding shares from 1,898,154 to 1,789,815; the stated value of the preferred stock will be cut $842,802 and the number of shares from 203,000 to 194,180. The total capital reduction will be $36,680,900, of which $22,819,746 will be used to create a special property reserve.

Reserves will be increased in all by $24,380,079 and surplus by $4,066,182. The change will be reflected also in the elimination of $4,664,005 reacquired common and preferred shares included among assets and by a reduction of $3,570,636 in "investments and advances." Total assets and liabilities will be reduced from $351,423,390 to $343,188,750, as of September 30, 1932, from the write-down in capital.

At a meeting of the board of directors of North American Light & Power Company held the following day Edwin Gruhl of New York, president of North American Company, was elected president and F. W. Doolittle of New York, vice-president of North American, was elected a director to fill the vacancies caused by the death of Clement Studebaker, Jr.

▼

Capitalization of Expenses Ruled Out in Wisconsin

Ruling that "a public utility may not capitalize by adding to property value for rate purposes those items for which the consumer has already paid, through rates charged for service, and which were charged to maintenance or other operating expense," or more specifically, "overstated operating expenses may not be later charged as plant expenditures and included in a rate base on which future returns to the utility are figured," the Wisconsin Public Service Commission has with elaborate apologies denied the appeal for rehearing its order for reduction of rates for the Mondovi Telephone Company.

The commission states that it has "no desire or intention to reflect upon the integrity or motives of officers of the Mondovi Telephone Company, whom we hold in high regard. We hereby absolve the officers of this utility from deliberate intentions of deceiving or misleading the commission. It is unfortunate that this was the first case involving the principles discussed to come before the present commission."

▼

Electricity Taxed Twice in Pennsylvania

Electricity may be taxed twice by the State of Pennsylvania when it is generated by one company and resold by another, according to a ruling made last week by the Dauphin County Court. Judge William M. Hargest gave the opinion in a case brought by the Philadelphia Electric Company and entered judgment for the state for $19,926 unpaid gross receipts taxes.

The company contended the state, having collected tax from the selling utility, could not impose the tax again when the power was sold by the second utility. Judge Hargest, noting the question was "an important one," not definitely determined in Pennsylvania, said: "We conclude that the tax is a franchise or privilege tax and that imposing it upon the defendant for the exercise of the privilege of transmitting and selling its electric current, the defendant is not subjected to double taxation because the purchasers of that current are corporations which have in turn sold it to their customers and paid their own privilege or franchise tax upon it."

▼

Government to Control Utilities in Mexico

Federal control of power companies in Mexico is sought in a bill sponsored by President Rodriguez and favorably reported on by the committee on constitutional amendments. All power companies, according to the measure, upon which Congress will soon take action, would operate under federal concessions and federal regulations, instead of under control by the states.

A study by the committee showed that 95 per cent of the hydro-electric power in Mexico is produced by three foreign companies, the Canadian-owned Mexican Light & Power Company, 60 per cent; subsidiaries of Electric Bond & Share Company, 30 per cent, and the Compania Electrica de Chapala, 5 per cent. The remaining 5 per cent is distributed among 375 companies. "With indifference," the report states, "we have seen that during 1928-1929 the Electric Bond & Share Company of New York, the Byllesby Engineering Company of Chicago, the Mexican Light & Power Company of Canada have shrewdly and prudently bought up Mexican power plants, investing about $100,000,000. With a confidence contrasting with the pessimism then prevailing in regard to our political and financial outlook, these companies gathered in a great part of the sources of electric power in the nation."

Utility Stocks Advance

A mixture of gains and losses carried the "Electrical World" index up to 29.4, the highest point recorded since mid-November. This compares with 28.3 for the preceding week.

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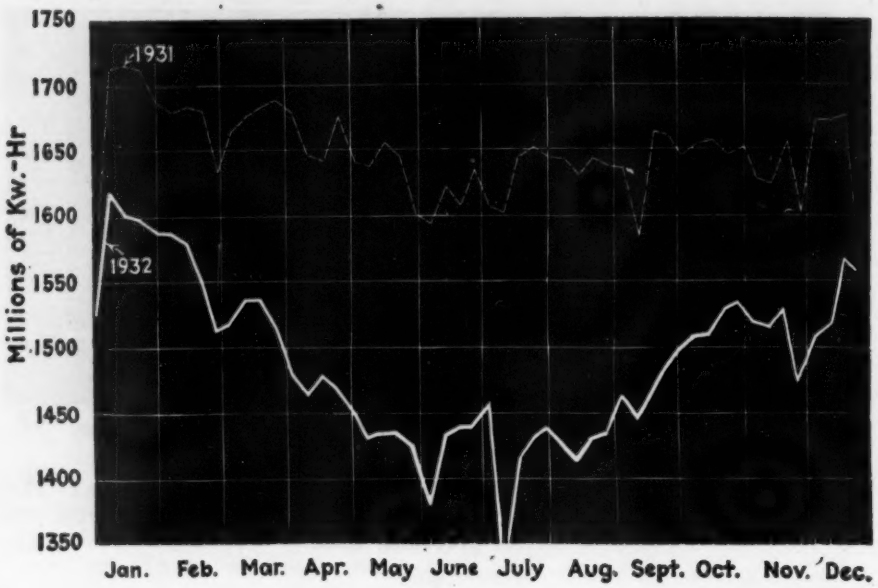
Output Holds Up in Pre-Christmas Week



Energy output of central electric light and power plants during the week ended December 24 was 1,554,473,000 kw.-hr. This constitutes a slight decrease from the preceding week, which had brought a rather pronounced rise, but otherwise conforms with the upward trend prevailing since midsummer.

In view of the circumstance that the corresponding week of 1931 included Christmas, comparisons with that year would be of little significance and are therefore omitted. This applies to the regional figures as well as those for the country as a whole.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1932	1931	1930	1929
December 24.....	1,554	1,565	1,617	1,638
December 17.....	1,563	1,676	1,770	1,860
December 10.....	1,519	1,672	1,748	1,841
December 3.....	1,510	1,671	1,747	1,806
November 26.....	1,475	1,600	1,672	1,718

▼

British Energy Output at New High in November

If the output of electrical energy is any basis for judging industrial conditions and the general economic status of the populace in Great Britain, that nation is forging ahead in a most encouraging manner. The output of electricity for November constitutes a record in the history of the British industry with 1,228,000,000 kw.-hr., an advance of 130,000,000 kw.-hr. over October and 133,000,000 kw.-hr. higher than in November, 1931. This increase of 12 per cent brings the improvement for the first eleven months of 1932 to 7.5 per cent over the corresponding period of 1931.

The sharp expansion in the November output appears to support the contention of the British that in many areas the industrial use of electricity is now going ahead. One of the large supply companies serving the coal, iron, and steel trades reports an upturn in the industrial demand after a two-year decline.

On the domestic side electricity supply is expanding at a rapid rate and there is still no sign of a saturation point being reached for of the 12,000,000 houses in Great Britain only one in three are reported wired for the use of electricity and the number wired for anything more than lighting service is estimated at not more than one in ten. The present average consumption per wired house is 500 kw.-hr. a year.

▼

Energy Output Shows Rise at German Power Stations

Statistics recently made available and covering about half of the total energy generated by German electrical enterprises indicates a sustained rise in output since last July. This, of course, duplicates the story told by production statistics in this country and may to a large measure be seasonal.

The energy used by industries during working days shows improvement. During the first three-quarters of this year the energy generated by the stations reporting for the survey (about 50 per cent of the national output) and used for commercial and industrial purposes amunted to 3,500,000,000 kw.-hr. as compared with 4,100,000,000 kw.-hr. in the same period of 1931.

On the basis of general output the comparative index figures for July, August, September and October were, respectively, 87.23, 91.25, 93.21 and 99.68. On the basis of industrial and commercial use the figures for July, August and September were 81.81, 82.88 and 87.62. The comparison is with the previous year.

▼

Boston Rate Petitioners Make Commission Restive

Protracted efforts of the petitioners in the Boston Edison rate case to extend the examination of company witnesses into fields irrelevant to the main issues aroused the commission sitting in the matter to annoyed comment in last week's hearing. Commissioner Webber declared that the province of the board is to regulate and not to manage the company, and intimated that the commission is competent to determine the fairness of the existing rates without lengthy excursions into such minutiæ as the detailed prices day by day for interchange power and the profit or loss of the merchandising department. The commissioner commended the enterprise of the company in obtaining power business through the sale of steam heat, notwithstanding the fact that the latter is done at a loss at present.

Criticism by F. H. Sullivan of the petitioners' counsel that the company should be ordered out of the appliance business was met by the rejoinder that such a course would save the residential customers less than a dime a year each. F. M. Ives, counsel for the company, declared that the company's merchandising activities were an important factor in obtaining a 13 per cent increase in residential kilowatt-hour sales in 1931 over 1930, with a 5.7 per cent increase in revenue.

Superintendent Goodman of the statistical bureau testified that the company's radio broadcasting business has shown a profit from the beginning. Richard Lincoln, superintendent of the merchandising department, testified that the power companies of the country sell from 10 to 15 per cent of the electrical merchandise marketed. In the last three months the average cost of range wiring and installation was about $50. The hearing has been continued to January 4.

▼

Russia Manufactures Electrical Equipment

Rapid expansion in the manufacture of electrical equipment is reported from Russia, where both diversity of application and greatly increased volume as well as some technical advances are claimed, cable for use at 380,000 volts being the most spectacular.

Some of the more important accomplishments, abstracted from a list in the December issue of the *Economic Review* of the Soviet Union, are: Steam and hydraulic turbo-generators from 24,000- to 65,500-kw. capacity; condensers; high-pressure boilers, high-voltage cables and transformers, including cable for 380,000 volts, produced at the Northern Cable plant at Leningrad, and a 115,000-volt transformer at the Moscow Electric Combine; 3,000- to 6,000-volt motors; electric furnaces; electric blooming mills for the manufacture of metal pipe, with a capacity of 0.6 mile of pipe per hour; electric plows and harvesters; electric mining equipment; electric pumps for excavating work, and other electric apparatus and equipment, including many household articles.

▼

Contract and Sales Data Sought by New York Board

Following its recent order that all bills rendered by utility companies in New York State to customers on and after March 1, 1933, bear the names of the corporations actually providing the service, and prohibiting the imposition of penalities for slow payment of bills (ELECTRICAL WORLD, November 12, page 647), the New York Public Service Commission has issued two new orders directing all public utilities to file information concerning management and other contracts and fees paid since 1923 and to keep separate records showing the complete cost of merchandising activities as well as revenues derived from them, and the expenses, profit or loss entailed.

The first order states that "all persons and corporations subject to the provisions of the public service law be and are hereby directed to file with this commission on or before the first day of January, 1933, a certified copy of all management, construction, engineering, purchasing, auditing, financing or similar contracts executed by such persons or corporations, together with verified statements showing for each year beginning with January 1, 1923, the payment made under such contracts or agreements, and the account to which said payments have been charged on the books of the reporting person or corporations. . . . "

The order further requires the filing of a certified copy of the minutes of the corporation's board of directors authorizing or ratifying such contracts, as well as a statement showing any amendment to such contract or contracts after the date of first execution.

To make it possible to keep its own records in accord with the new ruling on merchandising activities after July 1, 1933, the commission's accounting system will be amended. Milo R. Maltbie, chairman of the commission, said some public utility companies apparently do not know whether their merchandising activities are causing losses or profits.

▼

Rehabilitation Committee Reports Further Gains

In addition to the commitments for $70,875,000 of modernization work previously reported (ELECTRICAL WORLD, November 12, page 647) the Committee on Industrial Rehabilitation, of which A. W. Robertson of Westinghouse is chairman, has recently indicated that further expenditures of $34,125,000 have been agreed upon.

Projects included in the most recent report vary from painting and repair work in factories and stores to actual construction of new buildings called for by industrial modernization plans. The movement is to be continued indefinitely, Mr. Robertson announces.

▼

New York Metal Prices

	Dec. 20, 1932 Cents per Pound	Dec. 27, 193 Cents per Pound
Copper, electrolytic	5.00	5.00
Lead, Am. & S. R. price	3.00	3.00
Antimony	5.40	5.40
Nickel ingot	35.00	35.00
Zinc, spot	3.475	3.475
Tin, Straits	22.85	22.80
Aluminum, 99 per cent.	23.30	23.30

Major New Construction This Week

Heavy-duty motors, transformers, compressors and electric pumping machinery will be installed at Hammond, Ind., oil refining plant of Shell Petroleum Corporation, as part of $500,000 expansion plan.

Los Angeles, Calif., plans steel tower transmission line to Hoover Dam project with substations, switching stations, etc. Fund of $23,000,000 being arranged.

Until January 10 Villisca, Iowa, asks bids for Diesel engine-generating units, switchboards, transformers, underground conduit lines and distribution equipment for city-owned plant. Estimated cost $150,000.

Heavy-duty motors, regulators, transformers and electric pumps will be installed in new pumping station at Chicago, Ill. A $2,327,000 project.

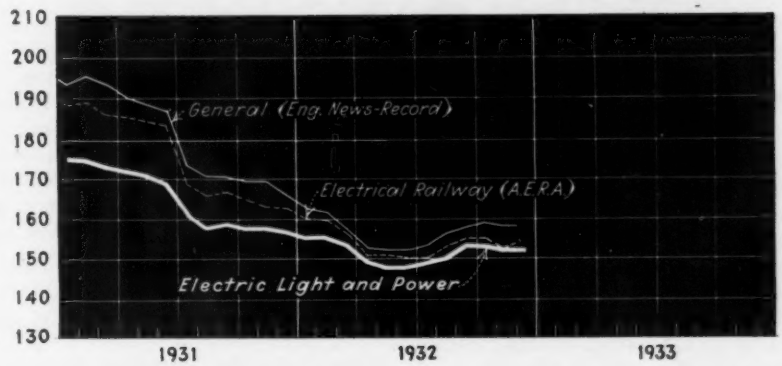
Machine drives, motors, transformers, regulators, conveyors, etc., will be installed in modernization program of Bavarian Brewing Company, Covington, Ky., to cost about $250,000.

Electric pumping machinery, hoists, motors, controls, etc., will be installed at new bulk storage plant of Wofford Oil Company, Augusta, Fla. Estimated cost over $200,000.

Standard Gas & Electric Company has authorized fund of $8,486,406 for extensions and improvements in electric light and power properties in 1933.

▼

Construction Costs Unchanged



Little variation in construction costs during the past few months is indicated in the various series of index numbers. In electric light and power they were at a minimum last May and June. A 3 per cent rise culminating in September and October was followed by a slight decrease in November and no further change in December. Recent fluctuations are shown in the chart and table.

Attention is called to the revision of the electric light and power index. The present figures are therefore not comparable with those previously published.

The complete series carried back to 1914 will appear in an early issue of the ELECTRICAL WORLD. This will supersede the table published in the issue of February 13, 1932.

Construction Cost Indexes: Electric Light and Power, Electric Railway and General

	Base: 1913 = 100		
	Electric Light and Power*	Electric Railway*	General—*Engineering News-Record*
December, 1932	152	153	158.5
November, 1932	152	152	158.2
October, 1932	153	154	159.2
September, 1932	153	155	158.0
August, 1932	150	153	156.8
July, 1932	149	150	153.4
December, 1931	157	163	166.2
Last 5 yrs high	185	206	210.4
Month	Jan., '30	Nov., '28	Feb. '29
Last 5 yrs low	148	150	152.2
Month	May, '32	June '32	June '32

*Computed by Albert S. Richey.

1932 Incandescent Lamp Sales

Incandescent lamp sales during 1932 totaled 546,600,000 for both large and miniature lamps, according to a preliminary estimate in the *General Electric Review*. This includes 330,800,000 large metal-filament lamps and 214,600,000 miniature lamps of the same type. The use of carbon-filament lamps continues to decrease. The total of these bulbs is estimated to be 1,200,000, about one-third of what it was in the previous year.

▼

High-Voltage Thyratron Tubes

For developmental investigation purposes a number of "Thyratron" tubes which can be operated at voltages of the order of 100 kv. have been produced by the General Electric Company. These tubes would be useful for direct-current transmission and other operations. Most of them are of the oxide-coated-cathode type and contain mercury vapor as the gas filling. The cathodes are rated at an average emission of 12 amp.

▼

Training in Air Conditioning

Technical training in air-conditioning problems and equipment is available to employees of Public Service Corporation of New Jersey at Rutgers University. This new educational course is designed primarily for men engaged in selling equipment and service and includes twelve sessions. It is part of the co-ordinated plan for employee education and training maintained by Public Service. Employees are given a reduced tuition fee.

▼

Phanotron Rectifiers in Boston

Four months of successful operation have been completed with the phanotron rectifier unit installed at the Salem Street substation of the Edison Electric Illuminating Company of Boston. The equipment has been carrying loads since August, varying from 320 to 550 amp., and has been in practically continuous operation (ELECTRICAL WORLD, December 3, page 739).

▼

Englewood Permanently Enjoined

Plans for construction of a municipal electric and water plant in Englewood, Colo., have been halted by Federal Judge Symes' grant of a permanent injunction against the project, for which a $750,000 bond issue was voted at a special election on September 2 (ELECTRICAL WORLD, September 17, 1932, page 355). The court decision questions the circumstances in which a contract for the work was awarded and asserts that, as the city has plenary powers to regulate the rates and services of the plaintiffs (Colorado Central Power Company), duplication of the plant would be economic waste. Attorneys for the city believe that bidding can be reopened and contract awarded without another municipal election.

▼

Lamp Investigation Ordered

Just how serious Japanese competition in the electric lamp industry may be is soon to be determined by the United States Tariff Commission, which has ordered an investigation of bulbs and lamps, with and without metallic filaments, to determine differences in costs of production with regard to those manufactured in this country and abroad.

▼

If there is a taint of materialism in this power age, don't charge it against the sciences which have discovered the various forms of power and developed them for mankind. Blame it against the spiritual unpreparedness of mankind to enjoy these gifts that have been brought through power; blame political science, sociology, psychology and theology.

MICHAEL T. PUPIN
Scientist

[Dr. Pupin last week predicted the time when mankind would look on the flame of burning coal and oil with reverence.]

▼

Coin-in-Slot-Washers Popular

Taking a hint from the success which met the quarter-a-day plan for installment sales of refrigerators, washing machine manufacturers have applied the idea to their business. According to J. R. Bohnen, secretary American Washing Machine Manufacturers' Association, many apartment house owners have adopted the plan, including some in Milwaukee and Kansas City, where, in the latter case, 300 have been installed by one firm. In 1932 there were 812,000 electric machines produced, a drop of 20 to 25 per cent below 1931.

▼

Manufacturers Seek Detroit Rate Cut

Counsel for the Michigan Manufacturers' Association, in a brief filed with the State Utilities Commission, has demanded an immediate order reducing by not to exceed 10 per cent the rates charged by the Detroit Edison Company. The brief asserted that the Edison company has failed in its reports to reveal the true state of its electrical business by not segregating the accounts of subsidiary companies. The company recently opposed the city of Detroit's petition to the commission for a complete audit and appraisal of the company and a temporary blanket reduction in rates (ELECTRICAL WORLD, December 3, page 742).

Associated Ban Lifted in Pennsylvania

Recent mandate of the Pennsylvania Securities Commission prohibiting the sale in Pennsylvania of the 5 and 6 per cent convertible obligations of the Associated Gas & Electric Company has been temporarily set aside by the United States District Court at Philadelphia. The restraining order of the court precludes the commission from enforcing the prohibition mandate or otherwise interfering with the sale of the securities until the legality of the mandate has been passed upon.

▼

Oswego, N. Y., Pumping Station Supply

To avoid repetition of the recent shutdown at the Oswego, N. Y., water works, due to a power circuit failure, Niagara Hudson Power Corporation, aided by General Electric engineers and a representative of the Public Service Commission, is planning a five-source tie-in with Oswego power plants, thus insuring an adequate supply to the pumping station under almost any contingency.

▼

Non-Payment Halts Court Service

Official business of Union County was conducted at El Dorado, Ark., last week by the light of lamps, candles and lanterns, as a result of electric service being discontinued in the courthouse for failure of the county to meet a $1,100 electric light and water bill of the Arkansas Power & Light Company. Water service was not discontinued and sufficient power to enable the heating plant to operate was maintained.

▼

Georgia Power Hit by Storm

Emerging triumphant from the snow and sleet storm which early last week struck the Southeast with unprecedented temperatures (ELECTRICAL WORLD, December 24, page 833), Georgia Power Company found it had suffered three major breaks in its 110-kv. lines and several in lower voltage classifications. Distribution lines were brought down in a number of areas. Repair crews in the Atlanta district worked for 38 hours before a relief crew arrived.

▼

Marlboro Electric Reduces Rates

Reduction in the domestic lighting rates of the Marlboro (Mass.) Electric Company, varying from ½ cent to 3 cents, as well as a reduction in the commercial rates, effective January 1, was ordered last week by the State Department of Public Utilities. The decision was handed down on the application of a group of customers.

Arc-Welded Modernization of Bridges Shows Savings

Savings ranging from 20 to 80 per cent in the reinforcement of old steel bridges by arc welding were reported by A. G. Leake, president Leake & Nelson Company, in a recent address before the American Welding Society at Boston. Weak or corroded joints in pin-connected eyebar bridges may be repaired and strengthened and additional bearing built up on pins when necessary without the use of falsework. Overlapping plates assembled at the weak joints are welded to obtain the required strength. If the eyebar section is reduced by corrosion it is a simple matter to reinforce the bars by welding plates to them. The fact that the joint is made rigid after welding does not detract from the method, as the plates can be made large enough to care for secondary stresses which may occur on account of fixation at the joint, and an inspection of many old pin-connected bridges shows little or no motion at the joints.

In reinforcing old structures by welding on new material proper loading of the latter is of vital importance where there is a considerable dead load, said Mr. Leake. Pre-stressing of the material by heating to a specified temperature, fixing both ends of the plate or bar by welding, and then cooling solves this problem since it produces in the plate a stress directly proportional to the elongation caused by heat application. In repairing the roof girders of a railway underpass in New York this method saved about $330,000.

▼

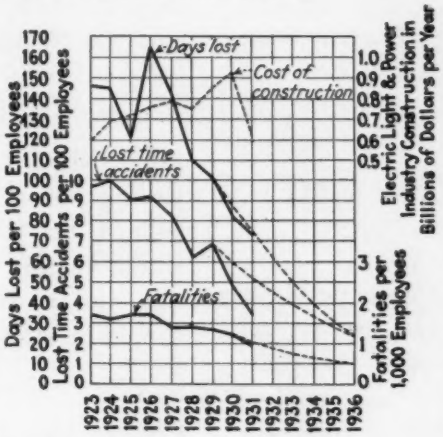
Exhauster System Installed in Large Grain Elevator

By a pneumatic system utilizing motor-driven centrifugal exhausters grain is unloaded from canalboats or ocean steamers and conveyed to the grain elevator at the Port of Albany, N. Y., which has the record-breaking storage capacity of 13,000,000 bushels. Elaborate tests conducted at Green Bay, Wis., indicated the centrifugal exhauster to be well adapted for this particular service and resulted in the installation at the Albany elevator of eight two-stage induction-motor-driven centrifugal exhausters, each unit having a capacity of from 2,500 to 4,000 bushels of grain per hour, depending upon the kind of grain handled.

The two-stage exhauster units are each driven by a 125-hp., 3,600-r.p.m. induction motor, the two stages being placed in separate housings mounted at either end of the motor with the exhauster impellers mounted directly on the extended motor shaft and supported by the ball bearings of the motor itself. The centrifugal exhausters draw the grain from the boats through unloading spouts and deliver it onto conveyor belts which transfer it to the grain elevator for storage.

▼

Utility Accidents Yield to Prevention Work



Pursuing the trend established in 1927, utility accident records, as compiled by the National Electric Light Association, continue to show marked reduction in working days lost, in the number of lost-time accidents and in the number of fatalities. Careful supervision and proper selection of employees, coupled with adequate training methods, are the recognized factors influencing the results. The bogeys set for numbers of lost-time accidents and fatalities per employee-units, as indicated by broken lines, once considered to be optimistic beyond all hope of achievement, are in a fair way to being surpassed.

▼

Courses Established for Unemployed Engineers

To enable unemployed engineers to refresh their technical and business knowledge, the engineering societies and colleges in the New York-New Jersey metropolitan district are arranging courses in engineering, economic and business subjects under the auspices of the Engineering Foundation. Unemployed or volunteer teachers will conduct the engineering study under the supervision of members of the faculties of Columbia University, New York University, Stevens Institute of Technology and the Polytechnic Institute of Brooklyn. The business courses will be special ones given by the faculty of the School of Commerce of New York University. Rooms for class use will be made available in the Engineering Societies Building. No tuition will be charged.

Improved Voltage Regulators Offer Simplicity at Low Cost

Constant-current (tub) transformers with floating coils for street lighting service are still familiar objects. Now comes E. T. Norris, chief transformer designer of Ferranti, Ltd., who describes in the *Electrical Review* (England) of December 9, a regulator for constant potential a.c. systems in which a short-circuited coil is moved along the core between two fixed coils connected to the load circuit to be regulated.

To grasp the principle, consider two coils, connected to, say, 100 volts and wound in opposite directions about a closed core with some appreciable sp between them. A short-circuited coil inserted between them will so modify the impedance of the nearer fixed coil as to make possible a wide range of adjustment of the relative potential of the tap between the two fixed coils. This in essence is the principle of the new regulator as available for practically 100 per cent regulation in laboratory test usage, etc.

Buck or boost can be accomplished by this same principle for the commercial range of 10 to 20 per cent regulation required for distribution circuits. One method connects one transformer terminal to the independent regulator midway between two coils connected at one side of the regulated circuit. The movable coil operates between one of these and the coil to which the other side of the regulated circuit is connected. The fourth regulator coil extends beyond the latter for boost purposes.

Characteristic performance of the regulator is represented by the same vector diagram as is drawn for a transformer. Low flux density minimizes iron losses. Magnetizing current is also practically sinusoidal. Copper loss is zero in the movable coil at no load regardless of its position and under load the coil current is proportional to the load current whatever the position of the movable coil. Mechanical forces are small and an induction-disc type of motor suffices, for all except the largest regulators, to shift the coil under the dictates of the contact-making voltmeter. Short circuit on the load side gives much lower stresses than in the corresponding power transformer. Three-phase regulators of this design have three wound legs on a three-legged core.

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A. S. T. M. Standards Indexed

An index of both standards and tentative standards adopted by the American Society for Testing Materials has been issued by that organization.

EDITORIALS

L.W.W.MORROW
Editor

Hard times and a neglected opportunity

TIMES change in the marketplace perhaps more rapidly than anywhere else and policy must change with them. Decisions made last year must be revised. Products important twelve months ago become secondary and lines voted of minor consequence then become a vital opportunity now. To the power company sales department domestic laundry equipment is a case in point.

Hard times have come a-knocking at the doors of thirty million homes—or thereabouts—and moved into most of them. And the habits and the needs of these homes have been affected. In the matter of the family laundry, for example, women who have never washed the clothes before are doing it today, because they cannot spend the money to send it to the laundry or to a wash woman. Wash day has come back into the kitchen and it presents a new market to the power company. Not just for driving a washing machine. That is only part of it. There is the water to be heated, there is the ironing and there are extra meals to be cooked, for, in many cases, another woman comes in to help at a depression wage that still leaves a saving.

The power company is interested from two angles: First, here is an opportunity to take advantage of this condition, to swing the drift of domestic washing back into the home. Suggest a manner of financing and a method of securing or saving the money elsewhere and there will be a surprisingly large percentage of homes where it can be done. And with the electric laundry once installed and the habit once established, this load will remain upon the lines. Second, here is a chance to build up the volume of merchandise sales. Merchandise men are eager for it, but prevailing policy obstructs. Therefore, all previous rulings on clothes washers, ironing machines, water heaters and ranges should be set aside today and a new study of the present problem should be made.

Obstructive habits of vice-presidents

"HOW can the home wiring committee best aid in the promotion of the complete electric home program?" This subject was billed for discussion at the session of the committee during the recent meeting of the N.E.L.A. National Sales Section in Chicago. It was not discussed. But surely the members of the home wiring committee must be intensely interested in the complete electric home program? Yes, indeed, they are intensely interested in it. Then why did they not discuss this subject of intense interest? The answer, dear reader, is that they did not know anything about it.

The book "That She May Have More Leisure," an excellent printing job presenting an excellent exposition of the economy, comfort and convenience of electricity in the home, prepared with much care and labor by the residence sales subcommittee of the merchandise sales committee under the active direction of J. H. Van Aernam, had been sent out to N.E.L.A. utility members some time before the meeting of the home wiring committee. Accompanying it was a plan detailing tested methods for selling the complete electric home. Of the forty pages in the book thirty deal specifically with adequate wiring. And one of the three objectives of the plan is "to sell adequate and complete wiring." Yet

of the group of twenty or more men from all over the country sitting in the home wiring committee meeting, not one, committee member or not, was able to talk informedly about the complete electric home program.

There was only one copy of the book in the room. It was held up by the committee chairman as he asked if any one present had read it. None. How many had even seen it? A few had, but had had no chance to study it because the copies they saw belonged to other people. One brother then arose and said he had seen a copy lying on a vice-presidential desk and evidently the vice-president had liked the pretty book and decided to keep it for his very own because it never got any farther into the organization.

The Lord made all forms of animal life and undoubtedly He intended that vice-presidents should perform certain useful functions. But it cannot be said that it is a useful function to prevent selling information from getting into the hands of the men who have to do the selling.

Irrelevant testimony in rate cases

AS A result of the opening of commission docket files to all comers a decided trend toward the introduction of irrelevant evidence and cross-questioning has set in in rate cases. The proceedings are often prolonged and costs of regulation increased by the efforts of ill-informed or hostile "file combers" to disclose incompetent management, waste of money and consequent excessive prices for service. Bizarre interpretations of annual returns, exhibits and reports appear in the proceedings before the boards and lead frequently to unfair assertions and distorted newspaper publicity, besides causing great inconvenience and expense to operating companies in meeting these allegations.

In a number of recent cases the opponents of the companies have sought to obtain highly involved cost allocations from the respondents on the basis of filed material relating to intercompany power contracts, system extensions, tie line developments, etc., with the object of proving extravagant management. The petitioners generally lack an accurate perspective of system development and often judge plant investments without appreciation of their soundness at the time they were decided. Excess capacity in 1932 does not prove, *per se,* that steps toward its provision in 1928 were unsound on conditions as then understood and anticipated, but company critics cannot always see this and sometimes do not wish to. It is gratifying to observe a tendency in commission circles to appreciate the cost of long investigations into programs which might have been carried out had system planning engineers been able to foresee the effects of the depression, and to refuse to order utilities to spend thousands of dollars on unnecessary estimates of the detailed costs of discarded alternatives.

American power pioneers in foreign lands

AN AMERICAN engineer traveling through Latin American countries reports that what impressed him most in his travels was the caliber of men representing American power interests abroad, their competence, their tactfulness and particularly their resourcefulness. Utility baiting is stronger in some countries than it is in the U. S. A. and many an American engineer is taking his life in his hands in remote hydro stations and transmission lines. And yet they carry on successfully. Handicapped by being foreigners, they establish friendships with and gain the respect of authorities and population. Left to their own resources, not being able to telephone the factory every time trouble happens, and further handicapped by being forced to handle not only American but European equipment, they maintain the equipment in excellent condition, train natives to operate and maintain equipment and render service that would be considered excellent in the United States.

Many an American utility man could learn from them how to handle complicated equipment with the most unskilled kind of help, and particularly how to train naturally unclean employees how to keep power houses and substations spotlessly clean without any additional expenditures. One system of about 500 miles of single-circuit lines shows the enviable record of seventeen minutes of interruption in two years. Modest men, competent men, cheerful men, resourceful men, such are American power pioneers abroad.

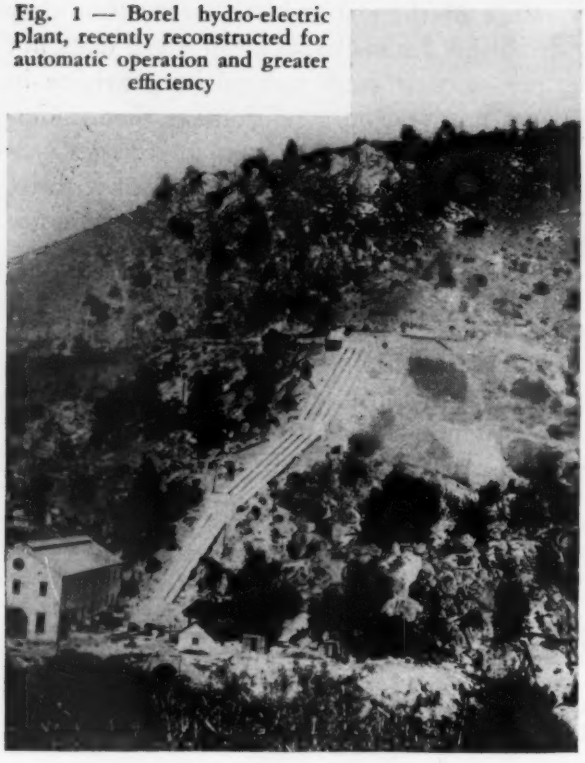


Fig. 1 — Borel hydro-electric plant, recently reconstructed for automatic operation and greater efficiency

Plant Rehabilitation Improves Operations

By J. B. DAVENPORT and E. M. SCOTT

Southern California Edison Company, Ltd.

Borel hydro plant of the Southern California Edison Company, rebuilt for automatic operation and better efficiency, saves 50 per cent in operating costs with 14 per cent increase in generation per year

DURING the early part of this year reconstruction of the Borel hydro plant of the Southern California Edison Company, Ltd., was completed. Reconstruction included the installation of a new automatic 5,000-kw. turbine and full automatic control for all units in the plant. As a result of the work this station now has a full load capacity of 10,000 kw. and is the largest on the Edison system to be made full automatic. Savings in yearly operating expense will approximate 50 per cent, at the same time increasing generation 14 per cent during a normal water year.

As the oldest of the four on the Kern River, Borel plant has had an interesting history. Built in 1904, the conduit exists at the present time as it was originally constructed, except for numerous flume replacements. The diversion dam on the Kern River is approximately a mile below the town of Kernville and the conduit, 11.3 miles long, ends at a forebay where a head of approximately 260 ft. is developed. This 600-sec.-ft. conduit parallels a portion of the Kern River where there is but little fall and consists of 10.3 miles of trapezoidal cement-lined ditch and approximately one mile of steel flume, which has replaced the original wooden flume. Water is conducted from the forebay into the power house through four 5-ft. penstocks, two of which are joined at the power house to supply water to the new unit.

Prior to the year 1930, when reconstruction was started, it had been necessary, from time to time, to replace 2,500 ft. of wooden flume with steel flume of modern design. In 1930 it became necessary to replace the remaining 2,700 ft. of flume if the plant were to be kept in operation. At that time an investigation was made as to the advisability of either replacing the flumes and reconstructing the plant for automatic operation or abandoning it altogether. If the plant were abandoned it would be necessary to replace its firm power and yearly generation by equivalent steam-electric generation at the Long Beach steam plant.

As a result of the study it was shown that it would be economically feasible to spend the money necessary to reconstruct the plant in order to make it automatic and replace the remaining original wooden flumes. A point which bears emphasis in a study of this nature is the fact that only the new money to be expended enters into the computation. Naturally, under present conditions, a plant of this nature would not be constructed, but with the plant constructed, the maintenance and operation costs plus the net return on the new investment determine the procedure to be followed.

In order to have an understanding of the problems which confronted the company in the course of making the plant automatic a brief description of the plant before its reconstruction is given. The equipment as originally installed in 1904 consisted of five horizontal turbines, each directly connected to a 2,000-kw. Bullock 2,200-volt, three-phase, 50-cycle, engine-type generator. Energy was fed into individual banks of transformers, the high sides of which were connected to one 54,000-volt bus. Power at this voltage was transmitted by two transmission lines 123 miles to Los Angeles.

Due to the low efficiency of the original wheels, an attempt was made in 1908 by another manufacturer to construct a turbine of greater efficiency to replace the original turbine of unit No. 5. A multi-jet, double-runner impulse wheel was constructed which was fitted with a draft tube. This design was found to be impractical as the wheel became badly waterlogged at loads above one-half wide open flow. This turbine was one of the five in operating condition at the time of the reconstruction.

In 1910, 1911 and 1912 the four remaining original wheels were replaced with single Pelton-Francis horizontal turbines, this change resulting in a considerable increase in hydraulic efficiency over the former wheels. At the time of the reconstruction these turbines, all similar in design, were in operation and were able to

take the entire full flow of the conduit. The fifth unit, above described, was used primarily as a synchronous condenser.

Four different plans considered in determining the most economical method of plant reconstruction were:

Making the plant automatic, retaining the existing equipment as far as possible.

Installing two 5,000-kw. automatic units in a new structure, retiring the old equipment completely.

Installing one 10,000-kw. automatic unit in a new structure, the old equipment being retired.

Installing one new automatic 5,000-kw. unit and in adapting two of the existing 2,000-kw. Pelton-Francis units for automatic control.

The fourth alternative was adopted because this plan of procedure gave the highest net return on the investment, after considering the fixed charges, operation and maintenance, and resulting generation. This conclusion is apparent if a study of the hydrograph of Kern River, shown in Fig. 2, is made. Conditions shown there indicate that under normal stream flow the new unit of 300 sec.-ft. capacity will be able to carry all the load 35 per cent of the time. The two older units can then be used to regulate the load with the remaining amount of water when available.

The plan adopted called for making the plant fully

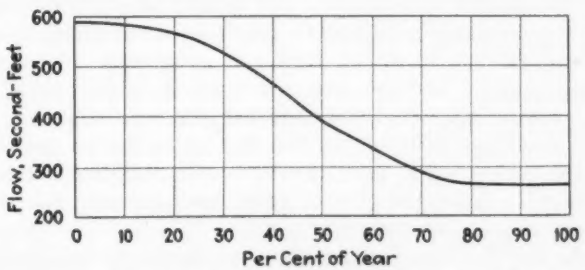


Fig. 2—Average flow of Kern River at station A will carry maximum plant output 35 per cent of the year

automatic with no regular attendance necessary in the station. This necessitated providing automatic synchronizing of units in event of line trouble, automatic Selsyn water control and automatic protection from failure of hydraulic or electrical equipment.

It is a relatively simple matter to have newly purchased apparatus operate satisfactorily with automatic control when designed with that intent in view. And, by the same token, it is relatively more difficult to make old equipment operate satisfactorily with simple automatic control. The final arrangement of equipment as it was selected for automatic control is shown in Fig. 5.

Major changes necessary to make the two 2,000-kw., horizontal turbine units now known as units 1 and 2 adaptable for automatic control resulted in retiring the obsolete governors of 1910 design and installing two Woodward type LRH, oil-operated, motor-driven governors fitted with Selsyn load control. It was also necessary to install new and reliable 2,200-volt, 1,200-amp. oil circuit breakers with a 42,500 amp. interrupting capacity to protect the generators. Generators formerly were supplied with excitation by means of a waterwheel-driven exciter, separate motor-driven exciters for each unit being substituted in the reconstruction. Motor-driven controls were provided for operating the bypass

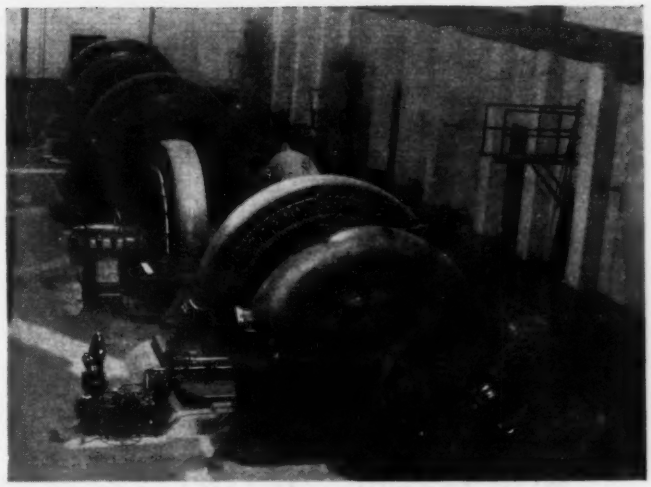


Fig. 3—Only two of the original 3,000-kw. units remain to operate in conjunction with the new 5,000-kw. unit

around the penstock shut-off valve located inside the station. In addition, an electrically operated control was provided for operating the main gate. Aside from the incidental protective and control equipment, these above listed renewals or revisions in the old equipment comprised the major changes to the then existing equipment that was to be reused.

The new turbine, designated as unit 3, was placed in the pit formerly occupied by unit 5, that unit being dismantled. It consisted of a vertical Pelton-Francis turbine directly connected to a General Electric 5,000-kw., 2,300-volt, three-phase, 50-cycle generator, equipped with a directly connected exciter. The unit was controlled by a Woodward type A actuator which was electrically driven by a motor head supplied through transformers on the generator leads. A new oil circuit breaker of 49,000 amp. interrupting capacity was also provided.

Five old banks of transformers were all removed and a new outdoor 2,300-volt/66,000-volt bank was provided to take the power of the three units in the reconstructed plant. This renewal, together with the new low-tension bus and new control switchboard, completed the changes to the old station.

It might be well to describe briefly the automatic control. It will be noted from Fig. 5 that there are two 66-kv. lines, the Monolith and the Kern River No. 3. The Monolith 66-kv. line is normally used to feed the plant load into the system. Should the Monolith breaker be tripped out due to line disturbance, when potential

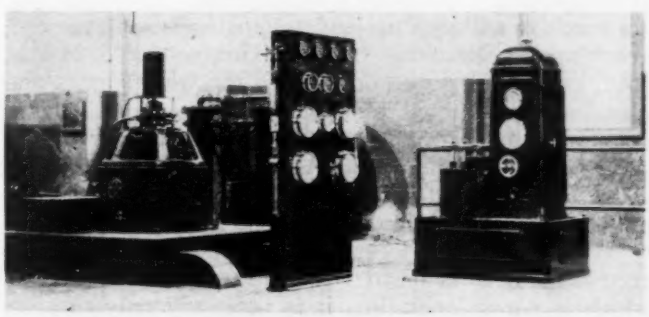


Fig. 4—Unit No. 3 installed at Borel power house
The comparison of both the appearance and operating characteristics of the new and old units is of interest.

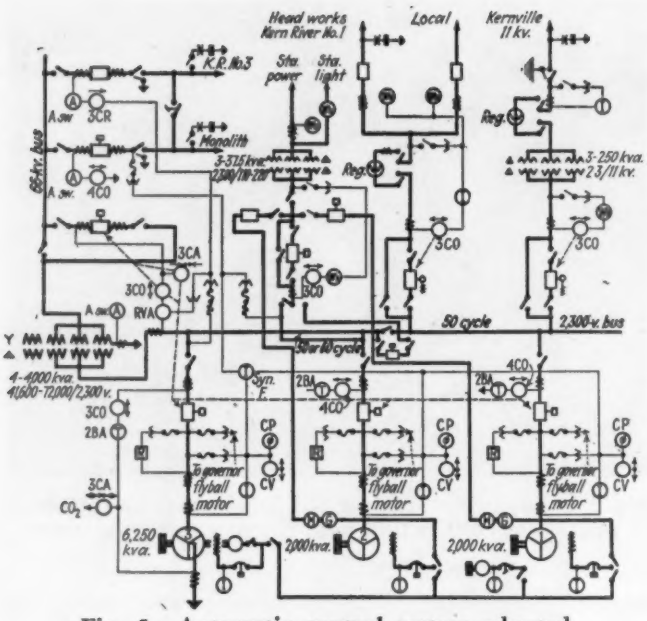


Fig. 5—Automatic control system adopted for the Borel project

is restored, a relay causes the automatic synchronizer to act on the machine selected. The line breaker is then closed and the station is restored to normal service. It should be noted that during line interruption the units are in synchronism on the 2,300-volt bus, supplying the local load demand over the 2,300 and 11,000-volt lines. Thus in a case of line trouble local service is not interrupted. It is to be further noted that the Kern River line No. 3 switch is open at the Kern River No. 3 plant, this line being used only under exceptional conditions, such as when Borel is operating at 60 cycles. In event of trouble on the 2,300-volt and 11,000-volt distribution circuits the lines will close and restore service, or, after a predetermined number of reclosures, they will lock out.

The generating units will trip off the bus and lock out under the following conditions:

1. Armature insulation failure indicated by residual relays on No. 1 and No. 2 units and differential relays on No. 3 unit.
2. Armature current overload on generator.
3. Generator field failure.
4. Excess generator guide or turbine bearing temperature.
5. Loss of governor oil pressure.
6. Operation of CO_2 equipment on unit 3.
7. Transformer differential or transformer overload.

The generating units will trip off the bus temporarily if the generator armature coils overheat. Upon cooling, the machine will pick up load automatically. Overspeed, resulting in overvoltage on the generator due to loss of load, causes the governor to close the wicket gates and also insert additional resistance in the exciter field to counteract the high potential which would otherwise be produced on the windings. All other sources of trouble cause an annunciator alarm only, which will bring an attendant to the station.

After a machine locks out and the trouble is corrected, or if it is desired to bring a unit on the line which is not in operation, it is necessary only to push two buttons and turn the master control switch. It would be possible to have one push-button station capable of starting a unit. However, the additional expense involved was not considered warranted. The first button to be pushed causes the motor control to open the bypass valve around the main hydraulic gate, permitting filling of the scroll case. When full and up to pressure, a pressure switch closes the circuit to the next control, allowing the main gate to be operated. The gate is opened then upon pressing another button, and when wide open it closes a circuit by means of a limit switch, allowing the master control to operate. The master control when closed starts a sequence which causes the governor to bring the unit up to 95 per cent speed, during which interval the voltage regulator takes control. The machine then is put on the bus by means of speed-matching motors and the automatic synchronizer, after which the synchronizer cuts out and one speed-matching motor picks up load to the limit block, or Selsyn control limit, and then cuts out. The machine is then checked for lubrication, voltage, load, etc.

Taking a machine off the line consists merely in shifting the Selsyn control over to another unit and turning the master control switch to the "stop" position. This shifts the load to other units through the Selsyn and the generator breaker trips the unit from the bus. The main gate closes, followed by the bypass valve. Closing the butterfly valve on unit No. 3 actuates the air brakes.

Generator automatic control systems are of standard Westinghouse manufacture and certain adaptations made by the company's engineers result in their meeting the special service to which they are assigned. The automatic control for the two old units does not differ in any major respect from that for the new unit No. 3. Old machines differ from the new in so far as the control is concerned in that they have separate motor-driven exciters. Also, the old, original hydraulically operated penstock gate valves were used.

As the WR^2 of the old units is practically double that of the new, some trouble was anticipated from this source. However, it was found that the difference in inertia was not sufficient to pull the units out of step during line trouble, at which time all units operating are held in synchronism on the bus, through exchange of synchronizing power.

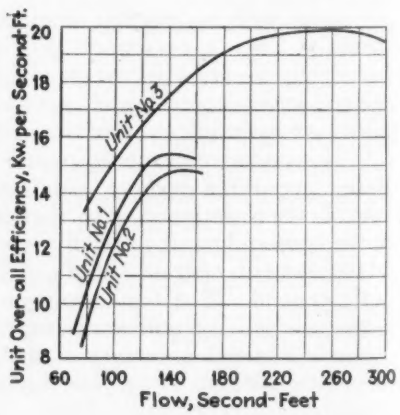


Fig. 6—Relative efficiency of the three units at Borel

Unit No. 3, capable of caring for the average flow 35 per cent of the time, is of the most modern hydraulic and electrical design. The marked difference in operating characteristics between the modern unit and those installed in 1904 is typical of the advantages of rehabilitation.

Upon testing the three units in the plant, using the salt velocity method, it was found that the new unit delivered 1,300 kw. more output when fully loaded than could be supplied by the two old units with the same amount of water. The turbine efficiency for the new unit was approximately 91.1 per cent at best points. Its relative efficiency, when compared to units Nos. 1 and

2, is shown in Fig. 6. This test substantiated fully the expected increase in generation resulting from the installation of a new unit. It will be seen that approximately one-third more power is obtained from the new unit with the same quantity of water. The new unit also can be operated automatically at 60 cycles if system conditions warrant, although running the machine at this frequency results in a 10 per cent loss in efficiency.

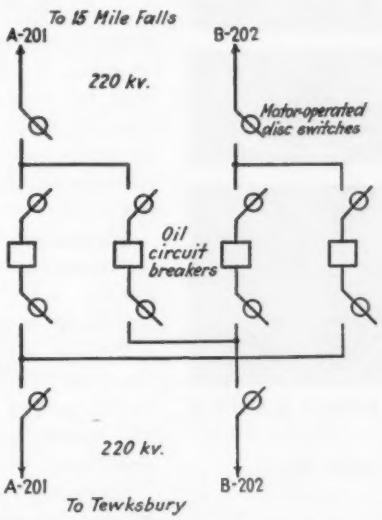
Completion of the reconstruction of this plant brought the total installed capacity on the Edison system now operating under automatic or semi-automatic control to 58,640 kw. The saving at this plant in operating expense will be at least 50 per cent. It would, of course, have been greater had a completely new plant been installed. This increase, however, would have been unfavorably counterbalanced by increased fixed charges. In addition to the decreased expense, the generation from the new plant will show an increase of 14 per cent during an average water year.

The Southern California Edison Company, Ltd., has been steadily progressing for the last ten years in making its stream-flow plants automatic or semi-automatic, whichever proved to be the more economical. At the end of the current year it is expected that all of its nineteen stream-flow plants will be so controlled, bringing the total capacity to 93,140 kw. It appears that only in this manner will the small, older and more inefficient hydro plants be able to approach the present kilowatt-hour cost of the efficient hydro or steam-electric generating stations of more modern design.

▼ ▼ ▼

Cost of 220-Kv. Sectionalizing Station

Midway between the Comerford station of the New England Power Association system at Fifteen-Mile Falls and the Tewksbury, Mass., terminus of the 126-mile, 220-kv. line transmitting energy from this development is a sectionalizing station designed to permit isolating trouble on either of the two circuits feeding through this point. The itemized cost of this installation was recently submitted to the Public Service Commission of New Hampshire by the engineering staff of the system and various significant details are printed below. Each circuit is three-phase with 795,000-circ.mil A.C.S.R. power conductors carried on semi-flexible steel towers, one line of towers being provided per circuit. There are two ½-in. steel ground wires per tower.



One-line diagram of switching facilities at Andover, N. H.

The sectionalizing station includes a 220-kv. bus structure 424 ft. 6 in. x 155 ft. over all, a 27 x 32-ft. control building and oil system with two 20,000-gal. storage tanks and pump house about 17x15 ft. The bus structure has four special switch towers on which are mounted inverted line disconnect switches; four standard 46-ft. line towers for dead-ending the high buses; three 32-ft. line towers to support a cross bus, and ten steel frames 40x13 ft. 9 in. x 22 ft. 3 in. high, on eight of which are mounted upright disconnecting switches. All towers have earth footings and the disconnect switch frames are anchored to concrete piers. The outdoor electrical equipment consists of four oil circuit breakers, 24 bushing type potential devices, eight upright gang-operated disconnect switches and four inverted gang-operated disconnects. The oil circuit breakers are 800-amp., 230-kv. units. Indoor equipment includes a 120-cell control storage battery, a 3½-kw. motor-generator set, 5-kw. automatic gas engine electric plant, switchboard for line control and other facilities.

Cost Data Summary Andover Switching Station

(Cents Omitted)

Local general	$13,683	Landscaping	$5,323
Construction plant and small tools	2,869	Land	4,454
Preliminary work	1,376	Interest during construction	6,786
Control house substructure	1,490	Contractors' and engineering expense	31,045
Control house superstructure	6,096	Grand total	$403,076
Oil house substructure	580	Four six-room semi-bungalows for operators' quarters	$33,913
Oil house superstructure	1,218	Water supply to control building	$1,148
Indoor electrical equipment	18,225		
Outdoor substation	309,924		

Representative Detailed Items

(Complete List Omitted for Lack of Space)

Field engineering, $2,933; taxes, boiler and fire insurance, $789; liability insurance, $1,102; watchman and lighting, $708.

Clearing site, 1 acre, $53; construction road, 500 ft., $565; preliminary survey, $757.

Control House Substructure:

Earth excavation, $116; backfill, $116; concrete ground floor, $349; concrete walls, $847; conduit casing, $60.

Control House Superstructure:

Brickwork, $2,687; cast stone, $245; structural steel, $214; switchboard trench, $178; plaster work, $64; granolithic floor, $328; gypsum roof, $320; doors and windows, $706; waterproofing roof; $349; heating, $312; plumbing, $268; painting, $315.

Oil house substructure, $580; superstructure, $1,218.

Indoor Electrical Equipment:

Switchboard erected, $11,552; control cable and conduit, $437; storage battery, $2,416; motor-generator and gas engine sets, $2,208; station lighting, $767; telephone equipment, $389; station service transformer, etc., $156; station power, $298; labor erecting four-panel switchboard, $1,994. Four GAX relays, $4,560.

Outdoor Substation:

Earth excavation, $9,227; backfill, $955; concrete, $3,564; structural steel erected, $15,413.

Oil circuit breakers, $192,234; bushings, $2,531; potential transformers, $11,751; disconnecting switches, $34.108; insulators, copper, etc., $13,378; control conductor and cable, $11,872; lighting, $470; painting and screening, $460; ground and ground wire, $2,099; oil pumps, filters and centrifuges, $1,129; piping, $1,377; tanks, $4,347; labor erecting oil circuit breakers, $4,731; breaker price, $180,511; labor erecting 24 potential tansformers, $118; labor erecting twelve motor-opeated disconnecting switches, $1,907.

Revenue Rises But Remains Under 1931

REVENUE of electric light and power companies in October was 7.4 per cent less than a year ago, operating expenses were 9.1 per cent and energy output was 9.6 per cent less, reports received by the ELECTRICAL WORLD indicate. Adjusted for 100 per cent of the industry, revenue was $165,410,000, compared with $178,630,000 a year ago, and operating expenses were $70,060,000, against $77,050,000. The latter does not include taxes, interest, depreciation or amortization. Of the output, which was close to 6,580,000,000 kw.-hr., water power produced 38 per cent.

These comparisons, combined with those for other recent months, indicate a tendency to get back to 1931 levels, though slowly. Such an apparent recovery, however, does not reflect present gains so much as it reflects last year's recession. Revenue for electric light and power always increases in the autumn. Last year the increase was smaller than usual; this year it is running parallel with the average for the past five years, and about 3 per cent below it. Consequently the disparity between 1931 and 1932 figures is shrinking. After spreading gradually to 9.3 per cent in August it is now 7.4 per cent.

In energy output also the year's difference, after attaining a maximum of 15.7 per cent in July, has been getting smaller. The allocation between fuel and water power has unusual features. Not only is the percentage of the latter uncommonly high for this season, but the increase over October, 1931, is exceptional. It amounted to 27 per cent. Correspondingly, fuel power decreased 24 per cent.

Expressed in energy units this latter decrease was about 1,300,000,000 kw.-hr. At 1.5 lb. of coal per kilowatt-hour it represents a reduction of a million tons of coal or its equivalent, and thus accounts for a considerable part of the $7,000,000 decrease in operating expenses previously mentioned.

Regionally, operations show few changes of importance from the preceding month. New England continues to come closest to 1931 figures, both in revenue and in energy sales. The Middle Atlantic region is next. With a decrease in revenue of 8.9 per cent from last year the East North Central region makes the best showing in months. The figures have been around 10 or 11 per cent.

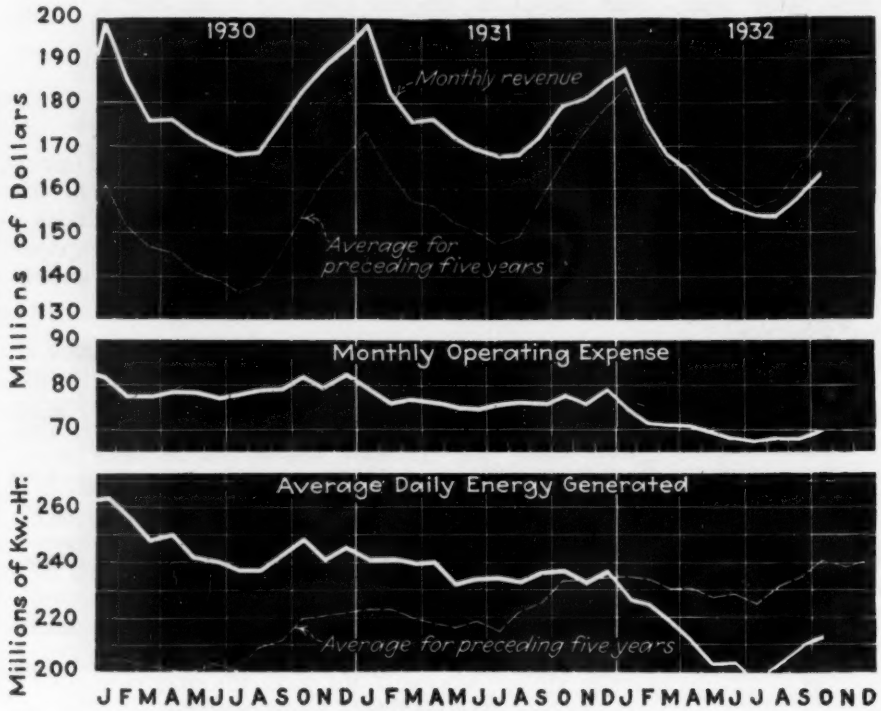


Table I—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1932	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
July	6,102,481	—15.7	2,495,937	— 0.3	3,606,544	—24.2	1,714,000	—10.0
August	6,306,682	—12.0	2,383,784	+ 5.4	3,922,898	—19.9	1,840,000	— 1.2
September	6,301,855	—11.2	2,231,228	+ 9.9	4,070,627	—19.8	1,876,000	+ 1.0
October	6,579,750	— 9.6	2,499,665	+27.2	4,080,085	—24.3	2,044,000	+ 7.2

Table II—Regional Operation, Revenue, Energy Output, in October, 1932

Compared with Corresponding Month of Previous Year

Region	Revenue		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	165,410	— 7.4	6,579,750	— 9.6	2,499,665	+27.2	4,080,085	—24.3
New England	17,650	— 4.2	470,224	— 6.2	215,440	+17.0	254,784	—19.8
Middle Atlantic	43,580	— 5.4	1,753,193	— 6.5	522,066	+35.3	1,231,127	—17.3
East North Central	37,810	— 8.9	1,523,837	— 8.2	126,174	—15.2	1,397,663	— 7.5
West North Central	13,710	— 8.4	429,165	—12.2	78,368	—21.2	350,797	—10.0
South Atlantic	18,030	— 6.8	764,209	—12.1	443,050	+79.0	321,159	—48.2
East South Central	5,690	—11.9	236,143	— 9.2	182,016	+15.8	54,127	—47.7
West South Central	9,710	—12.0	346,545	—15.5	3,254	—18.7	343,291	—15.3
Mountain	3,790	—12.2	184,835	—21.6	137,839	—19.0	46,996	—28.5
Pacific	15,440	— 7.0	871,599	—11.8	791,458	+58.0	80,141	—83.6

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central-station operations.

Table III—Central-Station Financial Operations in the United States

Compared with Corresponding Month of Previous Year

Month	Total Gross Revenue from Sale of Energy*		Total Operating and Maintenance Expense†	
	1932 Thousands	Per Cent Inc.	1932 Thousands	Per Cent Inc.
July	$152,370	— 8.9	$66,410	—11.6
August	152,020	— 9.3	68,370	— 9.5
Sept	159,040	— 7.5	68,410	— 9.1
Oct	165,410	— 7.4	70,060	— 9.1

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.

†Does not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions.

Problem of Power Supply for Resistance Welding

By W. C. HUTCHINS
Industrial Engineering Department, General Electric Company

PRODUCTION requirements of industry have shown a great need for speedier and more economical methods of fabricating steel and non-ferrous metal shapes. Extensive development and application of resistance welding in its several forms have helped in solving this problem, but at the same time have created for the power companies a new problem in power demand. Resistance welding can be divided into several main classifications, among which are spot welding, slow butt welding and flash welding, each having characteristic power requirements. The problem of supplying power to these processes and ways of overcoming the difficulties encountered can best be discussed after first tabulating some typical resistance welding loads.

Power and Time Required for Spot Welding—The following data apply to spot welding of clean sheet-steel work and are commercially accepted values:

U. S. Standard Gage	Kw. Required	Kva. at 33 per Cent Power Factor	Welding Time in Seconds
28	5	15.1	0.3
24	7	21.2	0.5
20	9	27.2	0.7
16	12	36.4	0.9
12	16	48.5	1.3
8	20	60.6	1.7
6	22	66.7	1.9

The power factor is usually between 25 and 50 per cent, depending upon the design.

Power and Time Required for Slow Butt Welding—

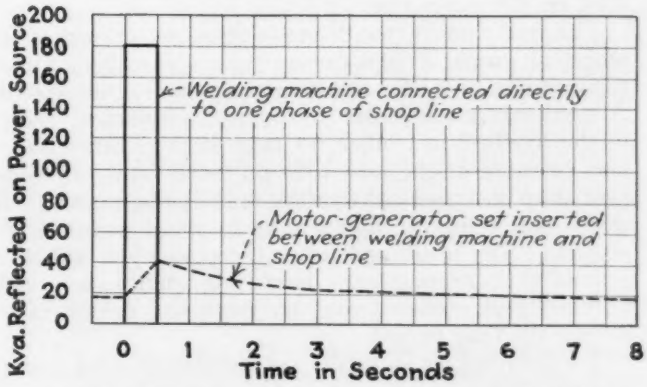
Diameter Round Stock in Inches	Kw. Required	Kva. at 60 per Cent Power Factor	Time in Seconds
0.5	5	8.4	5
1.0	18	30.0	20
1.5	50	83.3	40
2.0	75	125.0	50

The power factor of the average commercial machine usually varies between 50 and 70 per cent.

Power Requirements—Power requirements for both spot and slow butt welding of heavy stock are obviously similar and represent a difficult problem for the power companies because of the following peculiarly characteristic conditions: Single-phase, intermittent quick-changing load, very low power factor, total energy consumption low.

The following three methods have all been used in an attempt to improve the characteristics of such welding loads:

1. When power service is three-phase, interlock three welding machines of equal capacity to operate at the same instant, each being connected to a different phase.
2. Attempted distribution of single-phase load on *multiphase* line by means of special transformer connections.
3. Balancing of load on polyphase line and improvement of power factor by use of motor-generator set.



Load reflected on power source when welder is operated under different conditions

To balance the load of three welding machines of equal capacity is quite simple, when the stock is small and of thin gage and simultaneous welds can be made; however, when welding very heavy stock where the load is really objectionable, it is seldom that three machines of equal capacity are required. Even though this arrangement were possible, the load reflected on the shop line would still be quick changing and at a very low power factor.

It is practically impossible to transform from polyphase to single phase by means of static transformation and obtain balanced conditions. Various schemes have been proposed and investigated, but none of the combinations give better results than can be obtained by simply using a transformer across one phase.

The method of improving the characteristics of the resistance welding load by use of a motor-generator set is more satisfactory than any other and proves to be economical in a large number of installations. If the welding load is so large that the power company's existing line cannot stand the resulting unbalance, and the cost of bringing in a heavier line is prohibitive, it becomes necessary that either a motor-generator set be installed between the welding mechine and the power source or other methods of fabrication be adopted.

The advantages derived from the motor-generator set are as follows:

(a) Absolute balancing of single-phase load on three-phase line.
(b) Improvement of power factor.
(c) Independent control of generator voltage, producing more consistent welding conditions and permitting greater flexibility.
(d) Prevention of instantaneous load changes on the power system, if an induction motor with flywheel is used.

When a single-phase load is supplied by a motor-driven alternator the motor will balance the load on a three-phase line. The load on the power line will be increased a little, due to the losses in the motor-generator set. The other advantages, however, will in many cases

offset the additional total power consumption. Penalty charges for low power factor, single-phase and peak kva. demands will be reduced or entirely eliminated by the user of the set.

There are two main types of motors to be considered for driving alternators for this service, induction and synchronous. The synchronous motor has the advantages of (1) permitting control of power factor and (2) maintaining constant speed of the motor-generator set, which means constant generator voltage for a constant load on the alternator.

The induction motor-driven alternator set with a flywheel of proper design proves very advantageous when the duration of load is approximately one to two seconds. A small induction motor can store up sufficient energy in the flywheel and other rotating parts to carry 50 per cent or more of the load with no more than 5 or 6 per cent drop in speed. After the load is disconnected the motor will bring the flywheel up to speed within a few seconds. The resulting load on the power line will be of gradually increasing and decreasing values, a greatly reduced peak demand and an improved power factor during the load period.

The flywheel set is usually not suitable for load periods of more than a very few seconds. During longer periods the change in speed of the unit would be so great as to cause an appreciable change in the alternator terminal voltage, unless a flywheel of tremendous proportions were used. Of course, a motor sufficiently large would prevent an excessive speed drop, but would render a flywheel unnecessary.

A very good example showing the advantages of a motor-generator set with flywheel is cited below.

The problem was to weld together ends of steel angle members to form a framework. The welding was done at the rate of eight welds per minute. Each individual weld had a duration of one-half second, demanding power at the rate of 180 kva. at 50 per cent power factor. Incidentally, the load was imposed by the closing and opening of a line contactor. This produced practically instantaneous load changes.

A special welding machine was designed and connected across one phase of the existing 440-volt, three-phase shop line. The instantaneous changes from no load to full load and back to no load within one-half second caused objectionable light flicker and current surges and it became necessary that something be done to improve these conditions, so a special power line was considered which would connect the welding load directly to one phase of a high capacity transmission line. The cost, however, was prohibitive.

It was found that a 180-kva. alternator driven by a small high-slip induction motor with flywheel would demand power gradually increasing in one-half second to a peak of 41.1 kva. at 90 per cent power factor and balanced on three phases. During this short period the speed of the unit would decrease approximately 5 per cent as the flywheel gives up the necessary energy. The welding load then being disconnected, the motor would bring the unit back to full speed in a few seconds, the power drawn by the motor gradually decreasing until only the losses of the motor-generator set were being supplied. The accompanying illustration shows the calculated comparative characteristics of the load with the welding machine connected directly to one phase of the shop line and with the motor-generator set inserted between the welding machine and the shop line.

The approximate power requirements for flash welding are as follows:

(a) Single-phase power at some standard voltage.
(b) 50 to 80 kva. per square inch of surface to be welded during flashing period.
(c) During "upset" it is necessary to maintain a current value as great as current for the flashing period.

During the flashing or arcing period the load is practically constant at 60 to 80 per cent power factor, after the initial current surge which occurs as the two surfaces are touched together to establish the arc. This surge is approximately 20 to 30 per cent greater than normal flashing current and at a power factor of 30 to 40 per cent.

During the "upset" period, when the parts being welded are forced together, the power factor of the load will decrease to approximately 40 per cent and the current will increase 100 to 200 per cent if connected to a constant voltage power source. The reasons for these changes are (1) the resistance of the arc is cut out of the circuit; (2) the reactance of the circuit remains unchanged. A contactor interrupts this peak demand after less than one second duration.

After each weld is completed there is necessarily a rest period while new stock is being placed in the machine to be welded. The result is an intermittent load.

The problem presented to the power companies is that of meeting this power demand without exceeding the allowable unbalance on a system and at the same time preventing objectionable voltage fluctuations.

In many instances the power companies resort to the installation of a special power line connected through a separate transformer to a high capacity source fully capable of withstanding these demands without serious voltage fluctuations. Often the distance is so great that the expense is prohibitive. Premiums ranging from $300 to $3,000 a month are being paid to the power companies by manufacturers for these special service lines to which a flash welder is directly connected.

How to deal with the problem

Several methods have been used in attempts to improve the load characteristics of flash welding, among which are included the following:

1. Attempted distribution of the single-phase loads on three-phase lines by means of ingenious but complicated transformer connections which, as previously described, are believed to have little or no value.
2. An overload contactor which opens when current rises 10 per cent above that for flashing period.
3. A motor-generator set interposed between welding machine and polyphase power source.

It has been found that a contactor can be connected in the welding circuit and adjusted to open when the upset current rises more than 10 per cent above the flashing current. In doing so the very high peak load which normally occurs as the weld is completed is prevented. This method, however, does not improve the power factor, the load remains single phase and the peak power demand is interrupted by the opening of the contactor.

A motor-generator set interposed as described above is the most satisfactory arrangement. It has the following advantages:

(a) Balances a single-phase load on a polyphase line.
(b) Improves the power factor of the load reflected on the power source.

(c) Reduces the peak demand for power.
(d) Reduces the rate of kva. increase and decrease reflected on the power line.
(e) Decreases the welding current interrupted at completion of weld.

Each of these advantages is explained as follows:

It is obvious that, since the welding load will be taken directly from the single-phase alternator, the driving motor will in turn balance the load on the polyphase line to which it is connected.

The power factor of the energy drawn by the motor will be dependent upon the design of the motor. A synchronous motor would enable the operator to control the power factor.

In explanation of items c, d and e it will be necessary to consider the welding load which is imposed upon the single-phase alternator.

The surge of current which naturally occurs in establishing the arc is at a low power factor and represents a relatively low kilowatt consumption. Consequently, when furnished by an alternator, the load is small on the driving motor. Incidentally, the surge in the joint to be welded is less when supplied by an alternator than when connected directly to a power line of constant voltage, since it is a characteristic of an alternator to deliver a decreasing voltage under an increasing load. This is especially true when the power factor is reduced and the load exceeds the normal rating of the alternator.

As the arc is established, due to its resistance, the power factor of the welding load improves, the voltage of the alternator rises and greater power is delivered by the alternator. When "upset" occurs, the arc resistance being cut out of the welding circuit, a larger current is drawn from the alternator at a much lower power factor. Again the alternator voltage droops and a large current surge is prevented. There is actually a reduction in kilowatt consumption, but increased current in the weld.

Since the soundness of a weld depends upon maintaining current in the weld equal to or greater than that of the flashing period, until the upset is completed, the characteristics of the alternator have no ill effects. Instead, advantages are realized: (1) The contactors on welding machines perform less severe duty, increasing their life, and (2) the peak load drawn by the motor decreases to a low value in two steps.

Example—Flash welding

A manufacturer desires to make resistance welded seams at the rate of 120 per hour on each of three machines. The following are the load requirements of each weld on the basis of being connected directly to a constant 440-volt power supply:

Flashing Period—Five seconds at 150 kva., 70 per cent power factor.
Upset—One second—300 kva. at approximately 40 per cent power factor.
No-Load Period—Twenty-four seconds required in replacing welded barrels with new stock to be welded.
Total Welding Cycle—Thirty seconds for each welding machine.

The following considerations make this an unattractive load:

1. Single-phase loads.
2. 150 to 300 kva. intermittent operations.
3. Power factors ranging from 40 to 70 per cent.
4. Total energy consumption low.
5. Rate of increase and decrease of loads almost instantaneous, peak load being interrupted.

The cost of power for such a load in some sections of the country is so great as to prohibit the use of this welding method for heavy stock. Some factors influencing the charges for energy are: Total energy consumption, power factor, peak demand, number of phases and rate at which load increases or decreases. This particular load is unfavorable in every respect. To connect it on the available three-phase shop line meant large voltage fluctuations impairing the operations of other electrical equipment in the same factory, causing objectionable light flicker, and also the resulting unbalance would exceed the allowable line limits. This situation lends itself very readily to the use of a synchronous motor-driven single-phase alternator to be inserted between the welding load and the power supply.

Peaks and power factor benefit

By this arrangement the following can be accomplished:

1. The load can be balanced on the three-phase power line by using a three-phase synchronous motor.
2. The power factor of the motor can be adjusted to any reasonable leading angle desired.
3. The power drawn by the motor will increase to the normal flashing load, running constant for a few seconds, then during "upset" will decrease in two steps to no-load condition.
4. The current to be interrupted by the welder contactors will be appreciably reduced, giving longer life to the tips.
5. If the synchronous motor is designed for a leading power factor under full load, there will always be corrective kva. for either full load or no load.
6. The open circuit voltage of the alternator will be 10 to 20 per cent higher than for full-load voltage, which will assist greatly in establishing the welding arc.

The welding load on the alternator during flashing period would be the same as when connected directly to the shop line, namely, 150 kva. at 440 volts and 70 per cent power factor lagging, the current being 341 amp. During upset, however, the alternator voltage would drop to 365 volts as a result of increased current at greatly reduced power factor. The actual power furnished by the alternator would be approximately 157 kva. at 40 per cent power factor and 365 volts, the current being 430 amp.

The synchronous motor driving the alternator will reflect the following balanced three-phase load on the shop line, which includes the losses of the generator set:

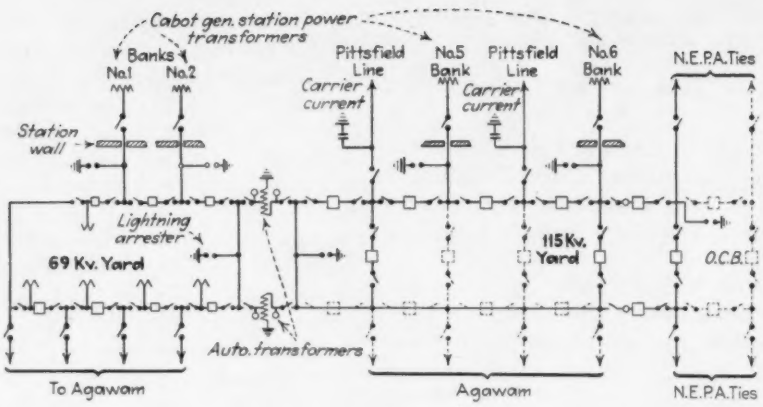
Flashing Period—130 kw., 163 kva. at 80 per cent power factor leading (compared with the 150 kva. single-phase load at 70 per cent power factor lagging if the welding load were connected directly to the shop line).
Upset—83 kw. 118 kva. at 70 per cent power factor leading (compared with 300 kva. single-phase load at 40 per cent power factor lagging if connected directly to shop line).

As explained above, the current to the welding machine during "upset" will be only 430 amp. when furnished by an alternator, compared with 682 amp. if machine were connected directly to the shop line. The lower current value to be interrupted means longer life for the contactor tips.

The no-load losses of a motor-generator set of proper design would be supplied to the motor at approximately 25 per cent leading power factor.

The open circuit voltage of the alternator will be 10 to 20 per cent higher than full-load voltage provided constant alternator excitation is maintained. The higher voltage will aid in establishing the arc by more easily breaking down the resistance of oxides and foreign matter which might be on the surfaces preventing good electrical contact.

By L. R. HICKS
Engineering Department
Western Massachusetts Companies



Single-line diagram of switchyard showing present and ultimate lines

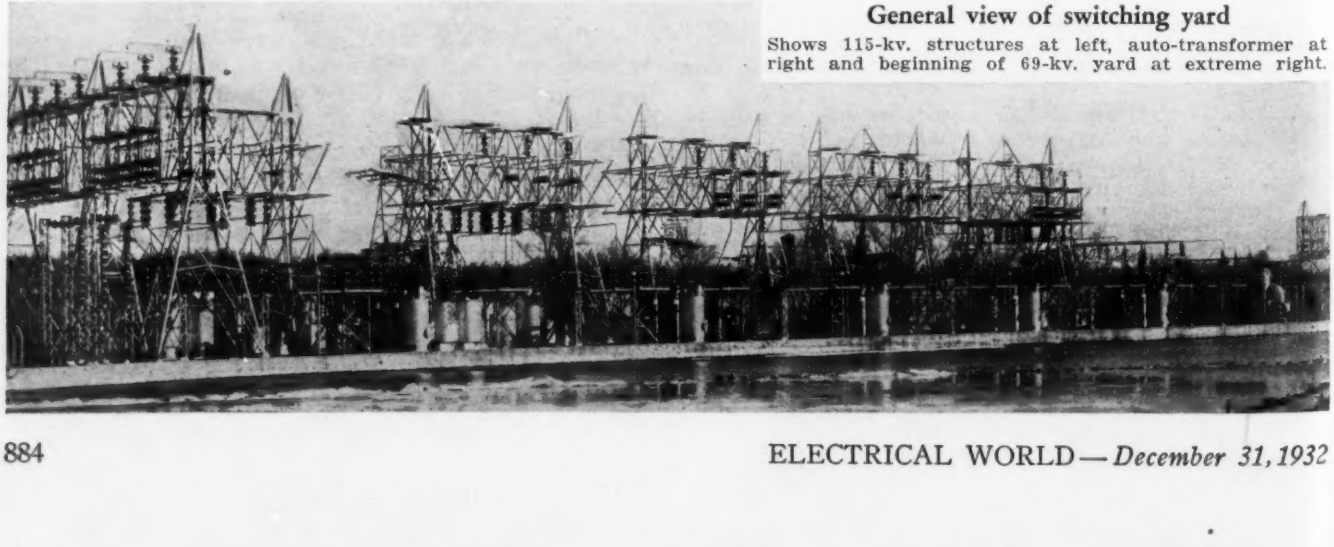
Flexible Switching Station on Site 60 Feet Wide

Two high-voltage yards in one.
Major interconnection provided.
Symmetrical layout for growth.

SWITCHING facilities for present and future requirements have been provided for 69- and 115-kv. lines on an area 600 ft. long x 60 ft. wide at the Cabot station of the Turners Falls (Mass.) Power & Electric Company in connection with a major tie-in with the New England Power Company and important improvements in the former's transmission system. The Cabot hydro plant began operation in 1916, generating at 6,900 volts. Four inside transformer banks delivered energy at 69 kv. through roof bushings to the outgoing lines serving the Connecticut Valley and later Pittsfield, Mass. Growth of load led to the need of circuit breakers of higher rupturing capacity; certain lines, including that to Pittsfield, were reinsulated for 115 kv. and a high capacity synchronizing tie-in with the New England Power system was provided in place of the previous non-synchronizing switching facilities at Leverett, Mass., through which energy had long been interchanged.

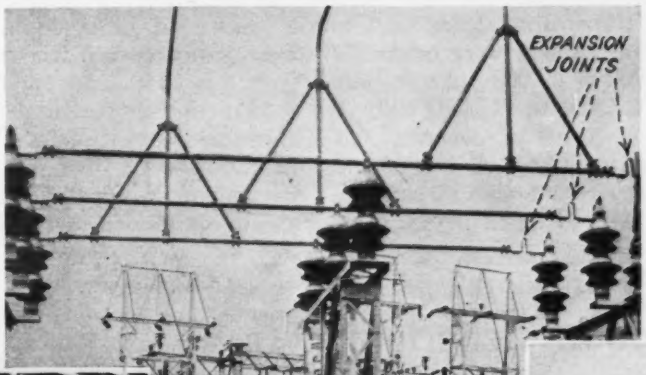
The Cabot switching station consists essentially of two ring buses tied together through two auto-transformers rated at 30,000 and 32,500 kva., the necessary circuit breakers, disconnecting switches, supporting structures and auxiliary metering and protective equipment. It is located on the opposite side of the station canal and forebay from the plant, and both yards are remote controlled from miniature switchboards on the operating gallery of the generating station. The long and narrow site influenced the design at nearly every point, but satisfactory spacing between conductors was obtained throughout. The normal horizontal spacing between 115 kv. tubing is 7 ft. 6 in., with 5-ft. minimum clearance between 69-kv. conductors. Flat bus construction is employed throughout. In general, the minimum clearance to 69-kv. flat buses is 14 ft. 5 in. above the concrete mat carrying the steel columns of the bus arbors. Buses are of 2-in. and 2½-in. extra heavy copper tubing.

At present the switching facilities control two 69-kv. circuits connecting the power transformer banks within the station to the 69-kv. bus yard, two 115-kv. circuits running from the corresponding transformer banks inside the station to the 115-kv. bus yard, four 69-kv. circuits to Agawam in the Springfield district, two 115-kv. circuits to Pittsfield and two 115-kv. tie circuits which connect with the Harriman-Millbury line of the New

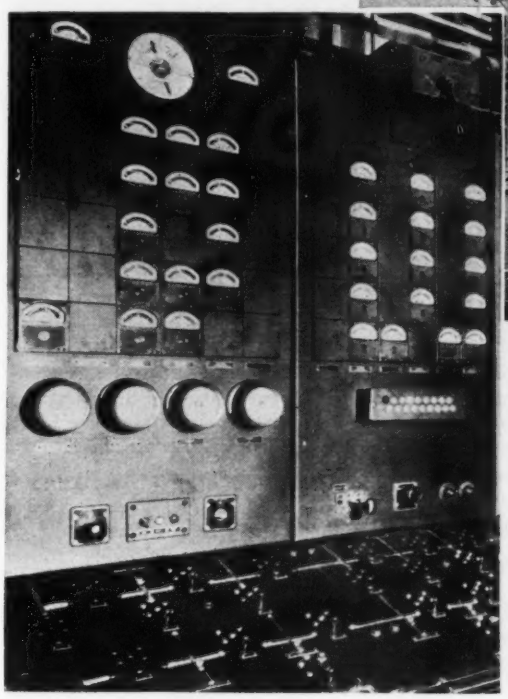


General view of switching yard
Shows 115-kv. structures at left, auto-transformer at right and beginning of 69-kv. yard at extreme right.

England Power Company about 3 miles from Cabot. The 115-kv. yard is laid out to accommodate six future circuits with the necessary breakers and auxiliary apparatus, two of these being planned for Agawam and two for doubling the present New England Power tie. The

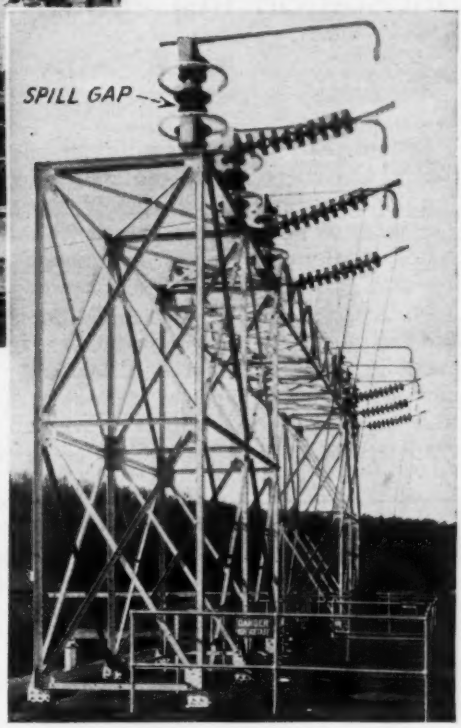


All control circuits, current transformer secondaries and metering equipment secondaries are run in lead-covered cable from the equipment in the yard to a terminal housing in a service building on the plot. Each wire of each



Miniature board and bus panels controlling 115-kv. yard

Method of supporting 69-kv. bus tubing, with taps to complete ring and expansion joint detail



Spillgaps on 115-kv. leads from station transformers

design of the yard provides for the introduction of these circuits on a symmetrical basis which greatly simplifies the future construction work necessary. The additional circuit breakers, disconnects and fittings required can virtually be dropped into place as indicated on the one-line yard diagram, with very little reorientation even in the case of the New England Power ties, which at present are brought into the yard longitudinally at the north end of the bus structure.

The 115-kv. yard provides ultimately for the equivalent of 1½ oil circuit breakers per circuit. Each circuit is connected between three breakers, but the adjacent circuit also uses one of these breakers in common. In plan, each set of breakers is arranged at the corner of an equilateral triangle. Those in the 115-kv. yard are rated at 1,500,000 kva. rupturing duty and in the 69-kv. yard at 1,000,000 kva. The present New England Power tie circuits are set to handle 50,000 kva.

No current transformers are used in the individual circuits of the yard layout. In each oil circuit breaker are two sets of bushing type current transformers, all those for any one circuit being connected in parallel and with each so connected to give the resultant current for any number of breakers that may be connected to the line. This resultant current is utilized to operate line relays, ammeters, and supply wattmeter current coils.

cable terminates on a separate stud to facilitate testing and construction work. From this terminal housing all circuits used on the relay board are run in conduit to top terminals on the relay board, and from the bottom of the relay board circuits are run back to the terminal housing. From the terminal housing to the main bench control panels in the generating plant 75-wire, No. 19 rubber and lead-covered cable is run in underground conduits about 700 ft. over all. This conduit was built into the canal wall and on the sidewalk as a parapet in place of a former hand rail barrier. This saved about 30 per cent over the next alternative method of installing the control circuits. It did, however, involve stepping down the 5-amp. secondary current to 0.05 amp. and providing special low-current meters. Direct-current opening and closing circuit service is handled by General Electric "HG" relays requiring about 0.25 amp.

Miniature type switchboard panels were employed to save space in the station operating gallery; otherwise extensive changes would have been necessary at an increase of about 25 to 30 per cent in switchboard cost.

Transformers are all equipped with differential relay protection and "Thyrite" arresters are connected on each side of the auto-transformers in the yard and on the leads from each transformer where these leave the station on the roof. Spillover gaps set at 18¼ in. are in-

stalled on the 115-kv. power transformer leads next to the roof bushings. These transformers were originally delta-delta connected from 6,900 to 69,000 volts and are now delta-star grounded from 6,900 to 115,000 volts.

In the switchyard a shallow form of concrete mat construction was adopted for mounting all equipment. The mat under the circuit breakers is a slab of concrete 12 in. thick set on a gravel base 10 to 12 in. thick, as in much road construction. The transformer foundations were similarly constructed except that the top slab is from 9 to 18 in. thick and 30-in. reinforced concrete beam construction is used under the steel rails supporting the auto-transformer skids. This foundation is from 3 to 12 in. above the yard grade. The arrangement cut down the amount of excavation and concrete to a minimum and in some cases saved over 50 per cent of the quantity.

▼ ▼ ▼

Substation Inspection Schedule

By J. G. LATTA
Lockport, N. Y.

In late years greater importance has been attached to the regular inspection of equipment on the theory that "an ounce of prevention is better than a pound of cure." The value of inspection is greatly diminished unless done systematically and unless an efficient method of making and preserving inspection reports is used. While intended for a typical unattended distribution substation in which the feeders are protected by automatic-reclosing breakers, the accompanying schedule may be readily modified for other types of stations or conditions.

A tentative schedule may be drawn up and mimeographed for trial. After final adoption printed forms may be used in which are outlined the various items to be checked, with blanks after each item for the inspector's findings. Cards may be used suitable for filing.

The reports are turned in to the party responsible for maintaining service and serve four important purposes: (1) To guard against the unintentional omission of any part of the inspection. (2) To keep the engineering department continually informed of conditions at the stations, so that needed alterations can be made in time to prevent damage to equipment. (3) To aid in placing responsibility for failures, should they occur. (4) To insure that an ample emergency stock of parts is carried at the station at all times.

For assurance of good service, a daily inspection of unattended substations is usually required, aside from the reading of meters. In some cases, supervisory systems, etc., may permit the interval between inspections to be increased.

Daily Inspection Report

Station .....Date .....Time .....

Attend to battery charging if started previous day.

If graphic meters are in operation, check ink and paper supply and remove charts.

Note positions of all maximum hands. Note any unusual readings in spaces provided.

Following lockout or period of severe service, isolate feeder O.C.B. and inspect contacts and oil. **Be sure both sets of disconnects are open** before removing tanks.

Check stock of spare contacts, etc., every time material is used. Report low stocks.

Keep all equipment clean.

Make note of any unusual or abnormal condition found, in space at bottom, with record of corrective measures taken.

Feeder	Watt-Hour Meter	O.C.B. Operation Counter	Ammeters			Regulator Max. Travel Hands		
			A	B	C	A	B	C

Regulator Temp. (75° or Higher)			Transformer Temp. (75° or Higher)
A	B	C	
			Transf. No. 1 Transf. No. 2 Transf. No. 3

Condition report and remarks.....

.....

Storage Battery

Test cells with hydrometer, 1,275-1,280 gravity constitutes a full charge.

Check level of electrolyte in each cell. Keep to ¼ in. depth above plates.

Inspect terminals for corrosion. If found, wipe clean, tighten and apply vaseline.

Delay start of charging so that charging for 24 hours at the (*) ampere rate will restore full charge without overcharging. Experience will determine the proper gravity reading, but it should never be less than 1,150.

Overhaul battery when it requires excessive recharging.

	Battery No. 1	Battery No. 2
Lowest cell reading.....		
Highest cell reading.....		
Distilled water added.....		
Batteries charged.....		
Date last charge.....		
Maintenance.....		

Remarks.....

**In this case this refers to a tripping battery for the primary O.C.B. Feeder breakers are a.c. motor-operated. A low charging rate, 2 amp. or less, is recommended so that charging may be frequent.*

Bi-Weekly Inspection Report

Station .....Date .....

Induction Regulators

Regulator No.	1	2	3	4	Etc.
(Manufacturer's instructions in this column, item by item, including check of C-M voltmeter, relay switch and limit switches, by manual operation through compensator.)					

Remarks.....

Monthly Inspection Report

Station .....Date .....

Operation check, feeder O.C.B.'s

Check each feeder in turn. Close by-pass disconnects.

Trip O.C.B. by raising bar over trip coils. Breaker should reclose (twice) if tripped after each closing and then lock out.

Reset relay and repeat test without tripping the (third) time. Relay should then reset itself. Open by-pass.

Report

Feeders, No.

Remarks .....

Quarterly Inspection Report

Note—This may be given space on monthly card.

Station .....Date .....

Overcharge batteries until all cells gas freely.

Apply No. 21 oil lightly to main and feeder O.C.B. toggles, leaf springs and motor shafts.

Clean all accessible equipment thoroughly.

Report and remarks.....

Semi-Annual Inspection Report

Station .....Date .....

Test oil in primary O.C.B. tanks, power transformers and induction regulators. Filter if unsatisfactory.

Note oil levels in all tanks and add clean, dry oil if necessary.

Isolate feeder O.C.B.'s with by-pass and disconnects, drop tanks and inspect contacts and oil levels. If oil is badly carbonized, replace it.

Fill grease cups on closing motors and regulator brake magnets.

Inspect all equipment and structure for loose bolts, cotters and electrical connections.

Check stock of spare parts with posted inventory. Report all shortages, and receipts of new parts.

Report of inspections.....

Remarks .....

What Home Owners Want

WHY doesn't the home maker, the merchant or the office executive respond more promptly to the ideas we in the electrical industry have, especially when we feel convinced that our proposals will benefit them? The answer is simple. Too frequently we reach conclusions without testing the reaction of the persons who will have to spend the money. We will probably find that they too recognize the benefits we have visualized, but we will also find out that we have overlooked some psychological reaction, some economic impediment or some other influencing factor which should be taken into consideration in the sales approach. By definitely ascertaining the obstacles in advance, more than half the sales resistance is overcome because we then have a definite problem to solve.

This was recognized by the Westinghouse Lamp Company in undertaking an extensive survey to find a better approach to the domestic market. While primarily aimed at increasing use of lighting, it included such fundamental information regarding customer habits that the approach to other domestic markets is also indicated. The extent of the survey, the purpose, the methods used and the type of information secured are briefly indicated in an accompanying panel.

The significance of the data secured may not be so clear until analyzed. Then it becomes apparent why we have failed to secure the buyer response we had hoped, and there are indications of the approach which should be made to attain greater success.

Purchasing habits

Purchase of lamp bulbs differs greatly, depending apparently on the relative convenience or standing of merchants in the community. For example, in Hartford 75 per cent purchase from utilities and 12 per cent from hardware stores; in Hackettstown, 55 per cent purchase from electric shops, 27 per cent from the utility, 10 per cent from the "5-and-10-cent" store; in metropolitan New York 35 per cent buy from hardware stores, 10 per cent from dealers, 12 per cent from utilities, 12 per cent from the "5-and-10-cent" store and 11 per cent from department stores. On the average, however, about one-third purchase from utilities, 31 per cent from electric shops, 15 per cent from hardware stores, 11 per cent from the "5-and-10-cent" store and 11 per cent from general department stores, wholesale grocery or drug stores. About 62-75 per cent keep a reserve stock of bulbs on hand and 45-67 per cent buy about five or more at one time.

No brand is specified by 50 per cent of the purchasers, but 39 per cent specify "Mazda" and the remaining 11 per cent Edison, General Electric or Westinghouse.

Lamps of 25 watts or less are purchased by 9-25 per cent of the people and 50-, 60- and 75-watt lamps by 5-27 per cent, depending on the community, Hartford having the highest percentage of the larger size purchases. The most popular sizes are apparently 25, 40 and 60, as these are purchased by 61-82 per cent of the people (see Table I).

Some odd answers developed when it came to checking the public's knowledge and opinion on lighting costs. Asked what they considered a reasonable electric light bill, the answers ranged from $1 a month to $10 or more. Sixteen per cent in Hartford, where they have been taught to recognize the large individual services rendered for a few cents, gave $10 or more as reasonable monthly bill, and 39 per cent gave $6 or more. Considering the survey as a whole, from 49-77 per cent gave $2-$5 per

Scope of Survey

Extent of Survey—Hartford, Conn. (100 families); Poughkeepsie, N. Y. (108); Hackettstown, N. J. (103); Westchester, N. Y. (125); Long Island (77); other New Jersey homes (46); metropolitan N. Y., apartments (7).

Included 67 per cent medium class homes (income $1,500-3,300); 13 per cent upper class (income more than $3,300); 27 per cent low class (income less than $1,500).

Type of Dwellings—73 per cent single-family houses; 26 per cent 2-4-family dwellings; 1 per cent apartments; 69 per cent owned, 30 per cent rented, 1 per cent part of income.

Purpose — Attitude of occupant toward artificial light, for decoration and health; buying habits and cost of lighting. (See also list of data secured by count.)

Methods of Survey—Personal interviews (see subjects); information classified by using seven Hollerith cards per house.

Table I—Predominating Size of Bulbs Used in Different Rooms by Type

(C. L. = ceiling fixture; W. L. = wall bracket; F. L. = floor lamp; T. L. = table lamp. In general, the more the sockets per fixture the smaller the rating. Table lamps had 1 to 3 sockets in living room; floor lamps 1 to 4 sockets; ceiling fixtures in dining room had 1 to 4 sockets. Figures below in parentheses show per cent of families using wattage indicated.)

Living Room

C. L — 25-watt (53 per cent); 40-watt (18 per cent).
W. L. — 25-watt (30 per cent).
F. L. — 40-watt (38 per cent) 25-watt; (26 per cent); 50-watt (20 per cent); 60-watt (18 per cent).
T. L. — 40-watt (35 per cent); 25-watt (30 per cent); 50-watt (19 per cent); 60-watt (12 per cent).

Dining Room

C. L. — 25-watt (41 per cent); 40-watt (18 per cent); 50- or 60-watt (10 per cent each).

Kitchen

C. L. — 60-watt (29 per cent); 40-watt (25 per cent); 75-watt (18 per cent).

Bathroom

W. L. or C. L. — 40-watt (30 per cent); 25-watt (25 per cent); 60-watt (18 per cent); 50-watt (15 per cent).

Bedroom

T. L. — 25-watt (29 per cent); 40-watt (20 per cent); 50-watt (10 per cent).
W. or C. L. — 25-watt (56 per cent); 40-watt (36 per cent); 50-watt (36 per cent).

Pantry or Alcove — 25-watt (13 per cent).

Garage — 25- or 40-watt (8 per cent each).

Other spaces, including attic, halls, closets, cellars — 25-watt (80 per cent); 40-watt (47 per cent); 15 watt (20 per cent).

month as a reasonable bill, depending on the community. Even the majority of comments on what constitutes a reasonable light bill were three times the national average.

To check the public's knowledge of lamp operating cost, they were asked how much it costs to light one bulb of the average size they use for one whole evening. Eighty-six to 98 per cent did not know, but in Hartford 11 per cent said 1-2 cents.

Compared with other services, 16 per cent of Hartford housewives declared that electric light is very cheap, whereas 12 per cent in another community said it is very expensive. Fifty-one to 80 per cent admit it is moderate, cheap or very cheap, depending on community and whether they have been allowed to think of rates as contrasted with service rendered for the total bill.

Regarding changes in lighting cost in the last ten years, 29-40 per cent had no knowledge. From 4-47 per cent declared there had been a rate decrease; from 11-38 per cent said bills are the same; from 12-27 per cent claimed their bills were larger. Notice the distinction between reference to bills and rates. The two highest percentage of reports of "decreased rates," namely, 47 per cent and 17 per cent, came from Hartford and Poughkeepsie, both of which keep their public informed on amount of service available for a small sum.

All this seems to prove that some companies have not done a good job making their customers distinguish between top rates and amount of service available for a small charge.

Appliances owned

The actual check of appliances owned does not reveal anything new as the data check very well with surveys which have been published before. However, reversed in terms of market available and class of customer, they may be stimulating at this time when some people think markets are saturated. Ranges and refrigerators show a sharp increase from the low to high economic class: Ranges, 2-21 per cent; refrigerators, 6-56 per cent (see Table II).

Extent of home lighting by room and type

More significant than the foregoing, however, were the data (Table III not opinion), collected by actual inspection, on the filled, unfilled, filled-but-not-used sockets and the wattage of bulbs used in ceiling, wall, floor, table and miscellaneous lamps in each room.

Pending consideration of subsequent data, suffice it to say that although empty sockets have always been considered a latent market, filled-but-unused sockets assume staggering proportions in many cases. Empty sockets are less frequent in the upper class homes, but, as the table summaries show, represent a sizable figure in the lower class homes. Ceiling and wall sockets are less frequently used in the poorer homes. Comparing classes, however, the living rooms show little difference in empty sockets. Table lamps haves a high use among the upper class.

The living room is the most important room in the house for lighting consumption.

Floor lamps are used freely by the upper classes, but not so freely, even when present, by the poorer classes. Floor lamps constitute the biggest consumption in both medium and high classes.

Quite the reverse of the living room, the dining rooms make greatest use of ceiling and wall fixtures among the upper classes. There is little difference in use of dining room lamps among classes. Ceiling lamps use the most energy in the dining room.

Kitchens and bathrooms are conspicuous because here there is a strikingly high utilization of lamps installed. In the kitchen ceiling outlets are the biggest consumers of energy for lighting.

In bedrooms there is a smaller percentage of empty sockets, but among the upper classes who use many miscellaneous lamps the percentage of disuse of filled sockets is high.

Table II—Electrical Appliances Owned by Different Classes

(Per cent of families owning appliances indicated)

	Economic Class — Low	Medium	High		Economic Class — Low	Medium	High
	Per Cent				Per Cent		
Iron	96	98	98	Sewing machine	6	19	32
Radio	76	93	95	Fan	5	8	29
Vacuum cleaner	45	82	93	Room heater	8	13	22
Toaster	51	77	86	Electric range	2	7	21
Waffle iron	18	33	58	Small stove	5	8	15
Refrigerator	6	28	56	Water heater	..	1	8
Percolator	10	30	50	Heating pad	1	4	7
Washer	32	42	41	Food mixer	1	2	7
Clock	8	20	41	Ray lamp	1	3	7
Curling iron	10	28	36	Egg boiler	..	1	5
				Ironer	..	3	4

Table III—Extent of Empty, Used and Filled-but-Not Used Sockets

	Economic Class — Low	Medium	High
	Per Cent		
Living Room			
C. L — Empty sockets	18	12	6
Used sockets	34	17	18
Filled but not used	48	71	76
W. L — Empty sockets	12	10	4
Used sockets	12	12	13
Filled but not used	76	78	83
F. L. — Empty sockets	5	2	1
Used sockets	62	68	80
Filled but not used	33	30	90
T. L. — Empty sockets	5	2	3
Used sockets	56	63	55
Filled but not used	39	35	42
Dining Room			
C. L. — Empty sockets	13	8	1
Used sockets	64	71	89
Filled but not used	23	21	10
W. L. — Empty sockets	14	5	5
Used sockets	14	38	59
Filled but not used	72	57	36
F. L. and T. L. — Empty sockets	15	5	0
Used sockets	45	65	56
Filled but not used	40	30	44
Kitchen			
C. L and W. L. — Empty sockets	5	2	2
Used sockets	88	92	93
Filled but not used	7	6	5
Bathroom			
C. L. and W. L. — Empty sockets	1	1	0
Used	99	95	98
Filled but not used	..	4	2
Bedroom			
C. L and W. L — Empty sockets	14	9	3
Used sockets	72	58	51
Filled but not used	14	33	46
F. L., T. L. and M — Empty sockets	4	2	2
Used sockets	84	83	82
Filled but not used	12	15	16

Table IV—Average Watts Installed for Lighting Different Rooms by Type

(C. L = ceiling fixture; W. L. = wall brackets; F. L = floor lamps; T. L. — table lamps; M. = miscellaneous lamps.)

	Economic Class		
	Low	Medium	High
Living room total	**175**	**280**	**385**
C. L.	80	80	75
W. L.	10	35	90
F. L.	55	95	110
T. L.	30	70	110
Dining room total	**100**	**120**	**145**
C. L.	85	95	100
W. L.	5	10	35
F. L.	..	5	5
T. L.	10	10	5
Kitchen total	**65**	**75**	**95**
C. L.	60	65	70
W. L	5	10	25
Bathroom total	**40**	**55**	**65**
C. L.	25	25	30
W. L.	15	30	35
Bedroom total	**55**	**85**	**140**
C. L.	30	30	35
W. L.	10	20	40
F. L.	..	5	10
T. L.	10	25	50
M.	5	5	5
Survey total	**435**	**615**	**830**
Halls	43	51	81
Miscellaneous	145	173	274
Grand total	623	839	1,185

N.E.L.A. average and recommended: L. R. = 252 (540); D. R. = 158 (230); kitchen = 87 (200); bathroom = 71 (100); bedroom = 98 (190); halls = 65 (150); miscellaneous = 219 (1,000). N.E.L.A. total average = 950; recommended 2,410.

How can portable lamps and appliances be used, or how can the home maker shift furniture to avoid monotony so long as convenience outlets are so conspicuous by their absence? And yet according to Table VI, no convenience outlets are available in the living rooms of 29 per cent of the low-class homes, 7 per cent of the medium, 4 per cent of the high. None is present in the dining rooms of 63 per cent of the low class, 35 per cent medium, 23 per cent high. None is present in the kitchens of 55 per cent of the low class, 34 per cent medium, 32 per cent high. None is present in the bathrooms of 98 per cent of the low class, 91 per cent medium, 86 per cent high class. None is present in the bedrooms of 73 per cent of the low class, 37 per cent medium or 22 per cent of the high class.

Convenience outlets glaringly lacking

From this record, and it is likely to be typical of the country, it appears that contractors have a big enough field available to keep themselves busy not only during these hard times but in the future, if they show the public the possibility of sharing in the comforts and conveniences of electricity if they install convenience outlets and if they submit a plan for financing the work which will appeal to the public.

If convenience outlets are not increased in number and location, the opportunity for sales of portable lamps and domestic appliances is limited, likewise the sale of kilowatt-hours to operate them. When the bottleneck is removed there is likely to be an increase in sales of all utilization and service equipment back to the power house. Every room needs more convenience outlets, but particularly the living, kitchen and dining rooms.

There has been such an effort to get customers to use 60-watt bulbs that it is interesting to observe the preference in sizes for different uses. The question arises whether it is the public's desire to economize in use of energy which influences usage or the desire to avoid concentration of too much light in insufficiently shielded single sources that will ruin esthetic effects or even cause eye discomfort. The data indicate that it is the esthetic or eye-comfort factors which rule, as many portable lamps are not designed so large wattage lamps can be used without spoiling the effect of the shades. Portable lamp manufacturers could be provided with fixtures for the tops of their stands that would permit using larger lamps for either direct or indirect lighting or both without spoiling the esthetic effect of the shades, regardless of texture.

With ceiling or wall fixtures it is doubtless the presence of lamps in the field of vision or concentrated spots of light that influence use of the lower wattage bulbs, although shields would minimize this deterrent to use of larger bulbs on wall brackets.

However, as shown later, the age or condition of the furniture influences the amount of light used.

According to the analysis of homes the dining room, showing the best natural illumination, also has the best artificial lighting, in the opinion of the home maker. While it is known that contrasts force the lower level up toward the higher level, it seems more probable that the better artificial lighting in this room is due to the fact that 74 per cent of the home makers declare their living rooms contain their favorite furnishings.

Dining rooms constitute the next best furnished room and also have a corresponding degree of artificial

Table V—Extent of Wall Switches

(Figures represent per cent of families using)

	Economic Class		
	Low	Medium	High
	Per Cent		
Living room	58	88	87
Dining room	49	84	93
Kitchen	9	28	39
Bathroom	6	24	44
Bedrooms	19	42	63

Table VI—Extent of Convenience Outlets

(Figures represent per cent of families using number shown per room)

The number of plugs which may be attached is greater than indicated because of ganged receptacles or multiple-receptacle adapters. For example, the percentage of homes having facilities for two or more plug attachents per room is as follows:

Class	L.R.	D.R.	K.	B.R.	B
Low	61	25	27	14	0
Medium	85	47	30	44	4
High	92	58	39	66	4

	Economic Class		
	Low	Medium	High
	Per Cent		
Living room			
None	29	7	4
1	34	26	10
2	29	36	25
3 or more	8	31	61
Dining room			
None	63	35	23
1	34	52	55
2 or more	3	13	22
Kitchen			
None	55	34	32
1	42	55	46
2 or more	3	11	22
Bathroom			
None	98	91	86
1	2	7	14
2	0	2	0
Bedroom			
None	73	37	22
1	25	50	32
2	1	11	37
3 or more	1	2	9

Table VII—Relation of Rewiring to Remodeling—Who Did Electrical Work?

Homemaker mentioned most extensive projects; consequently when whole installation was changed she did not mention details or subsequent additions and changes. Figures represent per cent of families in each category.

Type of House When Occupied	Length of Present Occupancy (Years)	Per Cent of Families: No Remodeling, no Rewiring	Remodeling, but no Rewiring	Wiring but not Remodeling	Both Rewiring and Remodeling	Nature of Electrical Work: Added Convenience Outlets	Change in Fixtures	Added Wiring	Total Installations	Added Light Outlets	Lighting Additions to House	Wiring for New Appliances	Work Recently Done by: Electrician	Neighbor or Relative	None
New House															
	Less than 10	72	2	20	6	18	1	..	1	4	4	6	30	6	64
	10-20	31	6	40	23	38	8	4	12	10	10	6	65	6	29
	More than 20	13	7	33	47	20	7	..	60	..	20	7	80	7	13
Quite new															
	Less than 10	76	3	11	10	10	5	2	2	7	5	3	30	5	65
	10-20	33	9	27	31	39	9	3	12	12	6	9	67	9	24
Old or remodeled															
	Less than 10	59	7	19	15	12	5	1	11	2	3	5	35	7	58
	10-20	12	5	25	59	23	7	5	46	8	12	7	73	13	14
	More than 20	19	..	19	62	10	..	..	76	..	14	5	72	14	14

lighting in the opinion of the owners. In kitchens the utilitarian value of light is apparently well recognized. Bedrooms, by vote of their owners, are the poorest lighted artificially. Apparently miscellaneous lamps used for decoration or convenience do not fulfill the lighting requirements and home makers will have to be shown how these miscellaneous lamps or ceiling and wall fixtures, conveniently controlled, can be made to meet their utilitarian requirements without losing the esthetic effect.

Table VIII—Some Changes in Lighting Facilities Desired by Home Makers

(Figures represent per cent of homemakers desiring change)

Living room — More convenience outlets (20 per cent); more portable lamps (10 per cent).
Dining room — More convenience outlets (13 per cent); new center fixtures (6 per cent).
Kitchen — More convenience outlets (8 per cent); added light (6 per cent).
Bathroom — Added light or 2 wall lights (4 per cent).
Bedroom — More convenience outlets (17 per cent); more lamps (6 per cent).
Closets — Light (38 per cent); if large (25 per cent); if large and dark (37 per cent).

Table IX—Relation of Amount of Light to Age of Furniture

(Used in medium class homes. Figures for watts in living room light outlets refer to ceiling fixture. Size A house has equivalent of one living room and three bedrooms, while B has one additional bedroom.)

Size of House	Age of furniture (Years)	Number: Useful Light Outlets	Portables	Bulbs in Outlets	Bulbs in Portables	Convenience Outlets	Plug Receptacles	Watts in: Light Outlets	Portables
A	Less than 10	14	6	20	8	8	13	650	300
A	10-20	13	5	18	6	6	10	590	245
A	More than 20; recent changes	13	4	16	5	5	6	570	205
A	More than 20; no recent changes	13	2	16	3	4	6	570	115
B	Less than 10	16	7	21	8	9	12	700	310
B	10-20	15	6	20	7	8	13	675	290
B	More than 20; recent changes	16	5	21	6	7	9	670	215
B	More than 20; no recent changes	14	3	18	4	3	5	650	170
	Living Room Only								
	1-4 years	..	3.1	2.8	4.2			75.6	174.6
	5-7 years	..	3.6	3.3	4.4			91.8	197.9
	8-10 years	..	2.9	2.8	4.1			77.3	169.6
	15-20 years	..	2.6	2.9	3.8			80.3	138.1
	25 or more years	..	2.0	2.2	2.8			65.3	115.9

Is wiring, including outlets and switches, given as much consideration as remodeling of houses or refurnishing? The accompanying data (Table VII) show that no wiring has been added to homes by more than 50 per cent of the families who have occupied them less than ten years, whereas 66 per cent of the families added no wiring after they have occupied a home more than ten years. The 33-40 per cent who did make electrical changes added chiefly outlets.

Who did the work where electrical changes were made? In homes occupied by present tenant less than ten years 30-35 per cent of the electrical changes were made by electricians, 5-7 per cent by neighbors or relatives and 58-64 per cent had no electricians recently. In homes of longer occupancy electricians have been used by 65-80 per cent of the families and less changes are made by neighbors and relatives. How can more persons be induced to use electrical contractors? That is a problem which will be solved when the buyer's viewpoint is more widely understood, but that is another story in itself.

The work which has been done by electricians was chiefly as follows: New convenience outlets, 35 per cent; complete rewiring, 32 per cent; repairs, 20 per cent; wiring for new appliances, 12 per cent; wiring for additions to house, 10 per cent; new fixtures, 9 per cent; additional light outlets, 8 per cent.

Electrical changes desired by home makers

It is responding to what the public wants and not trying to force our ideas down their throats that is likely to create more business for the electrical industry. Here is what this survey shows the home makers want by percentage responding:

More convenience outlets, 40 per cent; more portable lamps, 20 per cent; decorative living room wall brackets, 11 per cent; new center fixtures, 10 per cent (but 7 per cent want center fixture removed); extra lamps elsewhere, 7 per cent; wall brackets in kitchen or bath, 6 per cent; wall-switch control, 5 per cent; larger bulbs, 3 per cent; indirect lighting, 2 per cent; change lamp shades,

1 per cent. The rooms in which these changes are wanted are indicated in Table VIII. All declared they would have lights installed in closets if building today, but qualified this desire by 38 per cent surely; 65 per cent if large and dark. These desires should be brought to the attention of architects, home builders and renting agencies.

Relation of lighting to furniture

The extent to which a desire for better lighting is related to age of furniture has been left to the last, because on this relationship seems to hinge the significance of this survey. As shown by Table IX, whether you measure better lighting by useful light outlets, number of bulbs, lamp wattage, number of convenience outlets, etc., all the factors seem to point to the greater application of better lighting in homes where the furniture is less than ten years old. With increasing age of furniture there is less use of light, which is natural as no one wants to advertise old, frayed and marred furniture. The only exception is among newly married couples, or economic beginners, where there is a noticeably smaller use of light with new furniture, due doubtless to the fact that complete home furnishing has drawn heavily on the family finances or budget.

Homes with furnishings more than seven years old have the least light, those of five to seven years have the most light and those of one to four years old the second largest lighting.

Increased use of lighting increases the desire for new furniture that will show to better advantage.

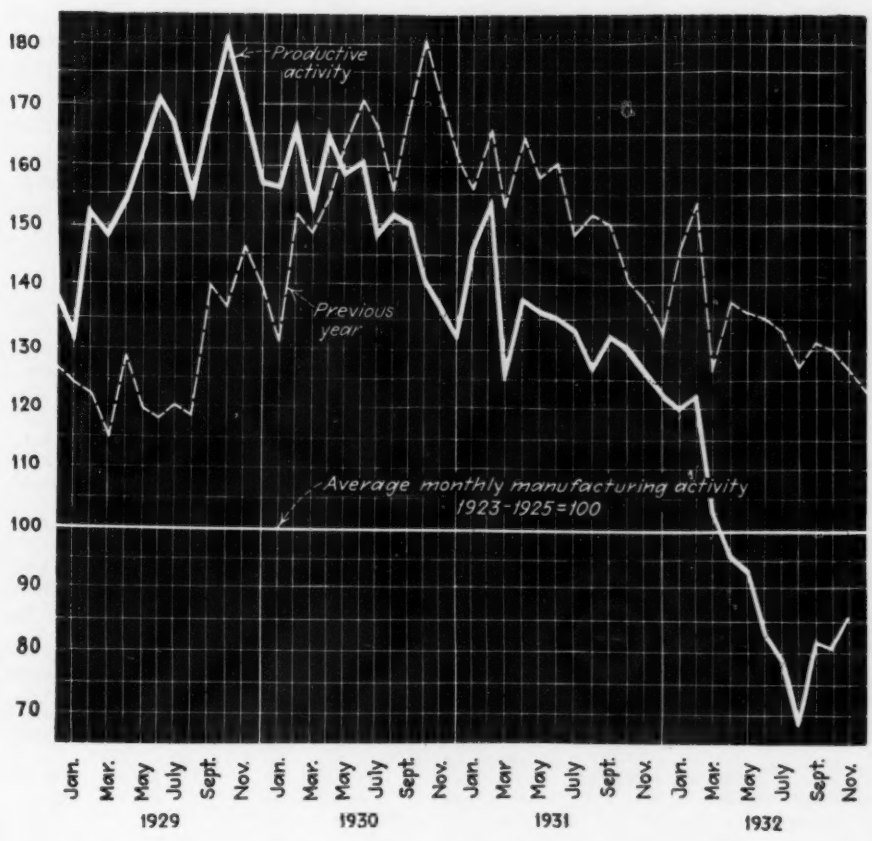
On this basis the Westinghouse Lamp Company has induced 225 department or furniture stores to start advocating better home lighting by displaying room sets with appropriate lighting. Arrangements are being made in these stores to demonstrate to the public how different pieces of furniture and lighting effects can be combined to produce attractive homes. In these demonstrations the utility home-service women will co-operate. For towns of 5,000 population or less, talking-picture sets are being furnished that demonstrate the same ideas.

Based on the findings in this survey and provided the country is brought up to the national average of lighting, which is 20 per cent below that of the higher class homes surveyed, the Westinghouse Lamp Company visualizes the potential home-lighting market as follows:

Portable lamps required 40,190,000 (about $286,000,000); additional lamp bulbs required 71,282,700 (on two-year life basis—$7,128,270); additional revenue for utilities at 6 cents per kilowatt-hour, $8,553,940. Without including wiring supplies, convenience outlets, switches, installation etc., this market aggregates nearly $300,000,000. To encourage equipping homes completely the Westinghouse Company considers it necessary to emphasize to the home maker the need of planning and acquiring equipment on a continuous basis, and how the home maker can acquire at the end of one year the complete ensemble she desires.

▼ ▼ ▼

Electrical Manufacturing More Active



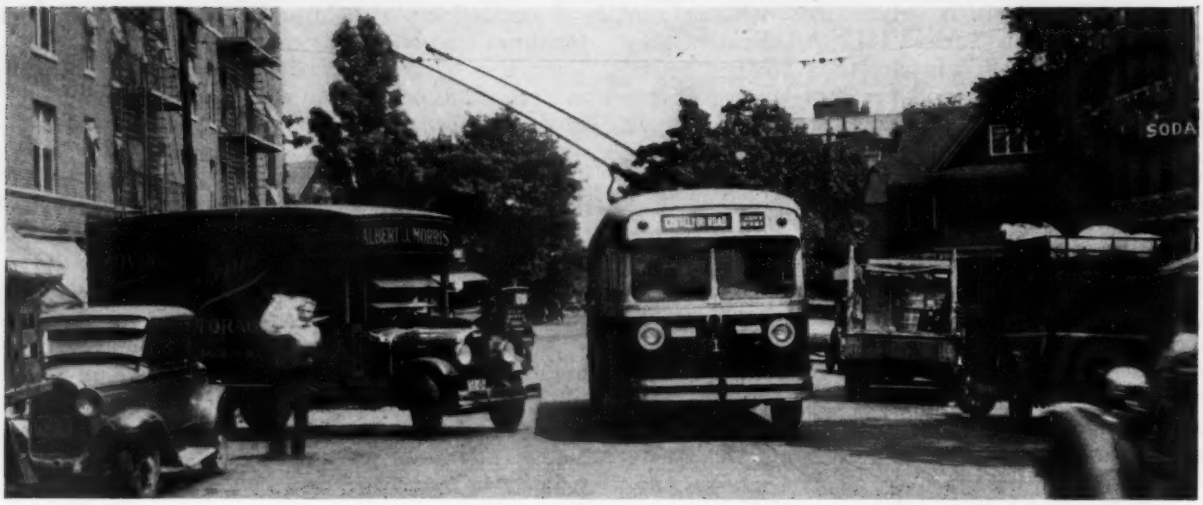
Productive activity in electrical manufacturing plants was 6 per cent greater in November than in October, it is shown by reports of energy consumption in that industry received by the ELECTRICAL WORLD. This comparison takes into account the difference in the number of working days. Similar comparisons for the past three years reveal a pronounced decrease. The upward movement is therefore in marked contrast with what occurred in 1929, 1930 and 1931.

Monthly Index of Electrical Manufacturing Activity

Adjusted to 26 working days
Base Average Month, 1923-1925

Month	1929	1930	1931	1932
January	131.3	156.2	146.6	120.0
February	151.8	165.2	154.3	122.2
March	148.3	153.0	126.1	102.9
April	154.6	164.9	138.1	95.6
May	163.5	158.0	136.7	92.8
June	170.5	160.2	135.2	83.1
July	166.6	148.5	133.4	79.2
August	155.4	152.2	126.9	67.6
September	168.8	150.0	132.6	81.4
October	180.6	140.6	130.4	80.9
November	169.5	137.5	126.9	85.6
December	157.0	132.4	123.5	.....

The greatest advance over October occurred in New England, 15 per cent. Strong gains were made also by some of the Midwestern appliance factories. As between large and small concerns, taken as a whole, no significant differences are evident.



A Market Worth Retaining and Building

By W. J. CLARDY
Railway Engineer
Westinghouse Electric & Manufacturing Company

Retaining existing business is just as important as securing new business, as every one should recognize. But what are electric light and power companies doing to retain the market for power in the street transportation field. In 1917 the revenue from this field constituted nearly 8.1 per cent of the total electric light and power revenue. Now it constitutes about 2.3 per cent. During the same interval the number of street cars operated has decreased from 80,000 to 65,000, due to the inadequate revenue on lightly traveled routes and automotive competition on these and other routes where transportation is needed. But despite this change in mode of transportation the present outlet for 6,362,000,000 kw.-hr. a year (10 per cent goes to electrified railroads) is worth saving and augmenting.

Trolley buses offer one means of saving this market for energy and also for increasing it. They permit utilizing existing street car facilities such as carbarns, shops, overhead d.c. distribution, substations, transmission and power plants, in which utilities have invested capital that they will have to "write off" the books if the outlet for energy is curtailed. Trolley buses combine many of the advantages of street cars and automotive buses, permitting flexibility and versatility of operation.

Already they are used in seventeen cities, ranging from 40,000 to 7,000,000 population, as Table I shows. In these installations their economy of operation has been demonstrated even though only 254 trolley buses are used at present. Eight new installations were made in 1931, but only 25 units were purchased in 1932.

Considering the inroads which automotive transportation has made on this outlet for power, it is worth a glance at the energy market represented by some typical trolley bus installations. Four interesting examples are shown in Table III.

Table I—Trolley Buses Adopted in Seventeen Cities

Property	Location	Electric Passenger Cars	Trolley Buses	Total Cars and Trolley Buses	Per Cent Trolley Buses
Brooklyn & Queens Transit Corporation	Brooklyn, N. Y.	2,239	8	2,247	0.4
Chicago Surface Lines	Chicago, Ill.	3,740	114	3,854	3.0
City of Detroit — Department of Street Railways	Detroit, Mich.	1,627	6	1,633	0.4
Duluth Street Railway	Duluth, Minn.	131	2	133	1.5
Fitchburg & Leominster Street Railway Company	Fitchburg, Mass.	0	7	7	100.0
Illinois Power & Light Company	Peoria, Ill.	113	5	118	4.2
Indianapolis Street Railway	Indianapolis, Ind.	467	15	482	3.1
Kansas Power & Light Company	Topeka, Kan.	67	4	71	5.6
Tennessee Public Service Company	Knoxville, Tenn.	81	4	85	4.7
Memphis Street Railway Company	Memphis, Tenn.	220	9	229	3.9
New Orleans Public Service Company	New Orleans, La.	705	13	718	1.8
Central Illinois Electric & Gas Company	Rockford, Ill.	58	4	62	6.5
St. Joseph Railway, Light, Heat & Power Company	St. Joseph, Mo.	93	6	99	6.1
Shreveport Railways Company	Shreveport, La.	47	5	52	9.6
United Electric Railway Company	Pawtucket, R. I.	431	4	435	1.0
Utah Light & Traction Company	Salt Lake City, Utah	131	26	157	16.7
Wisconsin Gas & Electric Company	Kenosha, Wis.	0	22	22	100.0
Totals		10,150	254	10,404	2.5

Table II—Electric Street Cars and Modern Trolley Buses Owned by Electric Railway Companies in U. S.

	Number Passenger Cars Owned	Purchases: Cars	Purchases: Trolley Buses	Passenger Cars Purchased Since 1/1/07	Passenger Cars Purchased Prior 1/1/07
1907	70,016	4,472	...	4,472	65,544
1908	.....	2,803	...	7,275	.....
1909	.....	3,526	...	10,801	.....
1910	.....	4,171	...	14,972	.....
1911	.....	3,141	...	18,113	.....
1912	76,162	4,751	...	22,864	53,298
1913	.....	3,648	...	26,512	.....
1914	.....	2,447	...	28,959	.....
1915	.....	2,329	...	31,288	.....
1916	.....	3,308	...	34,596	.....
1917	79,914	2,018	...	36,614	43,300
1918	79,391	2,087	...	38,701	40,690
1919	78,868	2,142	...	40,843	38,025
1920	78,345	3,040	...	43,883	34,462
1921	77,823	872	...	44,755	33,068
1922	77,301	2,792	...	47,547	29,754
1923	75,903	3,003	...	50,550	25,353
1924	74,505	2,277	...	52,827	21,678
1925	73,107	1,143	...	53,970	19,137
1926	71,708	1,425	...	55,395	16,313
1927	70,309	810	...	56,205	14,104
1928	68,928	469	26	56,674	12,254
1929	67,489	920	13	57,594	9,895
1930	66,103	604	106	58,198	7,905
1931	64,582	590	84	58,788	5,794
1932	.....	70	25	.....	.....

Table III—Typical Energy Uses for Trolley Buses

Location	Trolley Bus Kw.-Hr. per Year	Total Kw.-Hr.	Trolley Bus Kw.-Hr. Per Cent of Total
Large Midwestern city	7,920,000	541,000,000	1.46
Large Southern city	1,155,740	40,965,700	2.83
Medium-sized Western city	1,889,424	17,272,650	10.94
Small Midwestern city	3,180,000	3,180,000	100.00

Some 60,000 passenger units will serve the entire electric railway industry, which is a 7 per cent reduction from the present total cars and trolley buses owned to make an allowance for more efficient operation in the future. It is possible that from 10 to 20 per cent of this total may be trolley buses. A total of only 6,000 trolley buses would use more than 700,000,000 kw.-hr. annually.

Boilers Show 82-86% Availability

Extensive performance data were presented before the midwinter convention of the A.S.M.E. by C. F. Hirshfeld and G. U. Moran on 250 large steam-generating units, the information adding three years more experience to that included in the 1929 report. The chief object of the investigation was to study outages, their causes, effect of use, design, fuels and methods of firing with the hopes that operators might thereby be provided with some basis for comparing performance of their own units. Twelve-and-one-half pages are devoted to tables

*Major Outages and Causes**

	Stoker-Fired Units			Pulverized-Fuel-Fired Units		
Pressure Class	Order of Magnitude	Part of Unit Crippled	Reason for Outage	Order of Magnitude	Part of Unit Crippled	Reason for Outage
500–700 lb.	1	Furnace	(a) Plain refractory walls (b) Low fusion coal	1	Furnace	(a) Arch failures (b) Burned secondary-air-inlet parts
	2	Stoker	(a) Burned parts due to preheated air (b) Mechanical drive	2	Economizer	(a) Some tubes rerolled twice each month
	3	Boiler and superheater	(a) Overloaded soot blowers due to coal used (b) Replacement of tubes	1	Boiler and superheater	(a) Rearrangement of superheater supports (b) Failure of superheater tubes
400–499 lb.	1	Stoker	(a) Burned parts due to preheated air (b) High ratings (c) Removal of secondary rams and links on link grates	2	Furnace	(a) Rearrangement of front walls to secure more suitable air distribution
	2	Boiler and superheater	(a) Renewal of valve seats and disks	1	Furnace	(a) Failure of water-cooled steel blocks (b) Rebuilding refractory walls
	3	Cleaning gas side of heating surface	(a) Plugged air preheaters (b) Excess slag accumulation	2	Boiler and superheater	(a) Replacement of radiant-superheater elements (b) Superheater tubes cut by steam from misaligned soot blower
300–399 lb.	1	Stoker	(a) Burned stoker parts (b) Mechanical drive	3	Pulverizing equipment	(a) Renewal of mill hammers, liners, grinding balls
	2	Boiler and superheater	(a) Tube replacement (b) Valve repair (c) Failure of radiant superheater elements (d) Slag deposits	4	Draft equipment	(a) Vibration of induced-draft fans (b) Erosion of fan blades by fly ash (c) Failure of fan-shaft assemblies at preheaters
	3	Furnace	(a) Slag deposits (b) Rebuilding refractory walls			
200–299 lb.	1	Boiler and superheater	(a) Replacement of tubes	1	Boiler and superheater	(a) Tubes cut by steam from misaligned soot blowers (b) Overheated superheater tubes
	2	Furnace	(a) Rebuilding refractory walls			
	3	Stoker	(a) Burned parts due to low-ash, low-volatile coal (b) Mechanical drive			

*In the oil and gas-fired class (300-399 lb.) the boiler and superheater were the parts showing the great magnitude of outage due to (a) warping of support members by leaking gases and (b) leaking stop valves. The furnaces ranked next for outage due to chipping of burner wall brick.

covering 123 stoker-fired boilers, 87 pulverized-fuel, 24 oil and gas, six miscellaneous, eight reheat stoker-fired and two reheat pulverized-fuel.

One table lists by installation some twenty design factors, including heating areas in different parts, volume, areas, ratios, fuel B.t.u., method of firing and types of dust collectors and combustion control. Another table analyzes for these same boilers the per cent of rating under steaming, banked, reserve and crippled conditions, per cent of outage classified by part involved, and availability and use factors. Heat transfer rates were embodied in another table. The load duration curves for each class of units were also given. Summaries of these data were presented in six additional tables, one grouping the units by length of study, three others showing availability factors for unit and storage type pulverized fuel systems, underfeed and traveling grate stokers, and stokers with and without air preheaters, and the last listing outages and causes for three classes of boilers.

Analysis of the data can be made only by taking all the figures into consideration, so general conclusions are unsafe to make. However, the authors point out:

Modern equipment can be relied upon for use 82–86 per cent of the time. There is no appreciable difference in the reliability of pulverized-fuel and stoker-fired units. The outages due to stokers is somewhat greater but offset by other advantages. All groups have dropped slightly in availability since 1929; possibly the added age has some effect. The last table (reproduced here) is most illuminating in showing the effects of local conditions, grade of coal, experimenting with new ideas and understanding of use of preheated air. Storage-type pulverized fuel units have a slight advantage, the authors point out, but it cannot be given too much weight because of the difference between maximum, minimum and average figures. The same can be said of underfeed and traveling grate stokers. Preheat has reduced availability, but not as greatly as in 1929 data, evidently due to better knowledge.

All the boilers operated approximately at equal percentages of the ratings set by the designers, or about 60 per cent of the maximum continuous steaming capacity for 70–85 per cent of the steaming hours. Boilers operated at high unit rates were purposely designed for such conditions and have apparently fulfilled the intents of the designers.

Among the major causes of outages in the stoker class were: Difficulties with preheated air, wrong type of coal, plain refractory walls, slag accumulation and erosion, tube replacement and valves. In the pulverized-fuel class (300–399 lb.) the major outages were for replacing mill hammers, liners and grinding balls. Otherwise the outages were considered normal.

These data were collected during a period of rapid development, resulting in abnormal operating and maintenance conditions. Every indication points to an improvement in availability, the authors contend, but until designs are more standardized abnormal conditions may be expected to arise which distort any conclusions. For this reason further study will be delayed until development has become more nearly uniform.

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READERS' FORUM

Scenting Flaws in Proposals

To the Editor of the ELECTRICAL WORLD:

The well-presented article by Dean W. Taylor on page 788 of the December 10 issue again sounds the warning for retaining a capable consulting power plant engineer when considering the installation or substitution of power equipment. Consulting engineers as a group are our most trusted individuals and are not only able to make unbiased recommendations, but are also able to advise and to point out the jokers in an offered form of contract.

The fault with the salesman who lacks engineering knowledge is that he is only interested in getting a signature on the dotted line which ties up the customer to an ironbound contract in which it is up to others to make satisfactory delivery or fight it out. In fact, there is little need for a purely so-called salesman in the power plant machinery field who is not in the first place an engineer. Should a piece of equipment be needed, it does not take a salesman to sell it. If a piece of un-needed equipment is sold, it only results in a dissatisfied customer. If it is a case of price adjustment or revised contract form, such changes are made by the management. So that one gets back to the definition of a salesman as one who sells you something that you find later you do not want.

It is difficult for one to realize how an owner of an industry who shows great ability in managing affairs pertaining to the field of his particular product can assume that he also knows sufficient about his source of power requirement to form his own decisions intelligently when it comes to the increase or substitution of power or heat equipment. Power or heat generation or utilization is one of the most intricate of the professions and a most gigantic industry in itself.

The public utilities, in their effort to furnish power, are in the main honest and will welcome the retainment of an advisory engineer by the customer. Where is there another industry that requests that its rates be reduced (or selling price) as further economies present themselves, instead of being compelled to do so. Present low rates are largely due to energy being generated in large quantities, and for this reason alone the manufacturers of other products in the community should be favorable to the local public utility for their most economical production also.

For a community or a country to benefit all must benefit, and not just a handful of the most selfish individuals. Witness our present state of affairs, and, thanks to the engineers, a noble and honest profession. The fault is not that of the engineer, who has learned early in life not to misuse facts and natural laws if he doesn't want to burn or pinch his fingers. The engineer has given us many good things, a large number of which have been misused.

ALBERT H. MYERS.

3201 West National Avenue,
Milwaukee, Wis.

Men of the Industry

A. A. Potter New President of A.S.M.E.

Dr. Andrey A. Potter, who was elected president of the American Society of Mechanical Engineers (ELECTRICAL WORLD, December 10, page 770), has been dean of the engineering schools of Purdue University since 1920. Nationally known as an educator, Dean

Potter has devoted special attention in the course of his academic career to personal work for engineering students and to humanizing engineering education.

After receiving his technical education at the Massachusetts Institute of Technology and Kansas State College, he spent two years with the General Electric Company. Then he joined the teaching staff of Kansas State College, later becoming dean. After fifteen years of service in this institution he was named dean of the engineering schools at Purdue, in addition to director of the engineering experimental station.

While performing these duties Dr. Potter has, in addition, carried on a consulting engineering practice since 1913. His association activities he has not confined to the A.S.M.E., being a past-president of the Society for the Promotion of Engineering Education, the Indiana Engineering Society and the Kansas Engineering Society. He is the author of technical books and numerous articles and papers on power engineering and related subjects.

▼

L. M. CHRISTIE, who has been identified with the clay conduit branch of the electrical industry almost from its inception, has recently been elected a vice-president of the National Fireproofing Corporation, Pittsburgh, Pa. Since 1926 he has been special sales representative of the company for underground clay conduit and in his new executive position he will continue in charge of the sales and engineering work for the conduit division. ERNEST T. GILES, sales manager, was elected vice-president in charge of sales of the structural clay tile units, manufactured by the corporation.

•

WILLIAM E. SCHUBERT, for the past eight years chief engineer of the Wisconsin-Michigan Power Company, Appleton, has been appointed assistant general manager.

•

EDWARD STULTZ, for the last eight years manager of the Winchester district of the Northern Virginia Power Company, chief subsidiary of the Potomac Edison Company, has been appointed commercial manager of the entire Potomac Edison system, with offices in Hagerstown, Md.

•

PARKER SOREN, Hartford, Conn., has been appointed general manager of the Manchester (Conn.) Electric Company to succeed the late Lewis N. Heebner. Mr. Soren has had previous public utility experience with the Connecticut Power Company at New London and the Hartford Electric Company. He left the Hartford company in 1930 to join the Electric Bond & Share Company at Barranquilla, Colombia, and in 1931 returned to the Hartford utility.

•

RALPH E. MOODY, formerly assistant to S. B. Way, president of the Milwaukee Electric Railway & Light Company, has been appointed vice-president and general manager of the Wisconsin-Michigan Power Company, Appleton, Wis., to succeed A. K. Ellis, resigned. Mr. Moody became identified with the Milwaukee company following graduation from the University of Wisconsin, advancing from minor positions to assistant research engineer in 1919, research engineer in 1920 and to executive assistant nine years later.

•

HENRY D. SHARPE, president of the Brown & Sharpe Manufacturing Company, Providence, R. I., has been elected president of the New England Council, and will assume office January 1. Mr. Sharpe is one of the most prominent industrialists in New England, and has been Rhode Island vice-president of the council since its organization. He is a director of the New England Telephone & Telegraph Company, vice-president of the Providence Gas Company, chancellor of Brown University and chairman of the committee of the Chamber of Commerce of the United States on governmental competition with private business.

R. I. Brown Assumes New Executive Duties

R. I. Brown, formerly manager of the Little Rock division of the Arkansas Power & Light Company, has become vice-president and general manager of the Mississippi Power & Light Company, with headquarters at Jackson, Miss. Mr. Brown has been identified with the electric utility business in Little Rock for more than twenty years. Starting as a storeroom helper, he advanced through the meter department to be its superintendent, then changed to sales work, and in 1927 became man-

ager of commercial and power sales of the system. Subsequently, he was appointed to the managership of the Little Rock division. Mr. Brown is widely known in the National Electric Light Association, being at the present time chairman of the civic development committee of the Southwestern Division. He was an organizer of the Little Rock Electric Club, which he served first as secretary and later as president, and for several years has been secretary of the Arkansas Utilities Association.

▼

COL. SIR THOMAS F. PURVES, a past-president of the British Institution of Electrical Engineers, has recently retired from the position of engineer-in-chief to the British Post Office, which he has held for ten years. Sir Thomas has spent 43 years in government service. In addition to his technical services he has played a leading part in the development of international telephony in the more political aspect of conferences and committees. In 1929 he was elected president of the Institution of Electrical Engineers, and he has been president of the Institution of Post Office Electrical Engineers since 1922.

•

ALBERT G. CAGE has been appointed assistant general manager of the Southern Sierras Power Company, the Nevada-California Power Company and the Yuma Utilities Company, with head-

quarters in Riverside, Cal. With the exception of a period of time spent in military service during the World War and an eighteen-month furlough spent in the gas and electric department of the California Railroad Commission, Mr. Cage has been continuously identified with the Southern Sierras company since 1914. He was first employed in the engineering department, later was transferred to the commercial department, was appointed assistant general agent in 1922 and manager of the rate department early this year.

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OBITUARY

H. F. Parshall

Horace F. Parshall, noted electrical engineer, died December 21 in Bayonne, France, at the age of 67. Mr. Parshall, who was chairman of the board of directors and formerly executive head of the Central of London Railway, had acted as consulting engineer for enterprises in Great Britain and on the Continent since 1893, although he was born in America. A native of New York State, he received his technical education at Lehigh University and Tufts College. Before transferring his interests abroad, he was associated with the late Thomas A. Edison and subsequently with the General Electric Company. As consulting engineer to contractors of the Central of London Railway he successfully overcame opposition to his ideas, insisting on the introduction of multi-phase generation and transmission and the rotary converter system for the motive-power plant. He designed the installation for the Lancashire Electric Power Company, of which he was chairman. The Grampton prize, the Telford prize and the Telford gold medal were a few of the honors accorded him for technical monographs. He contributed liberally to the engineering societies and technical press on subjects relating to electric machine design and railway problems and was the author of several books on these subjects.

▼

IRA B. MATTHEWS, superintendent of the transformer department of the Toledo Edison Company, died suddenly, October 25. A native of Toledo and a graduate of Toledo University, Mr. Matthews spent his entire business career with utility enterprises in that city. Starting with the Western Union Telegraph Company, his connections included the Harrison Telephone Company, Buckeye Pipe Line Company, Toledo Western Electric Railway, Pennsylvania Railroad and Toledo Railways & Light Company, now the Toledo Edison Company. He was in the line department of this company until the organization of the transformer department, when he was made superintendent.

•

M. BERNARD WEBBER, assistant to the operating manager of the northeastern district of the New England Power Association, Arlington, Mass., died November 19 at Bedford, Mass., at the age of 45. He was a former president of the New England Gas Association and was well known in the New England utility field.

•

RICHARD B. HUSSEY, for many years an engineer in the street lighting department of the General Electric Company's Lynn factory, died at his home in Swampscott, Mass., December 6, at the age of 53. He was a graduate of Amherst College, and was on the staff of the Western Electric Company at New York for a year before going to Lynn. He had recently been placed on the retired list.

•

LEONARD G. VAN NESS, consulting engineer of Memphis, Tenn., and Lodi, Wis., died recently in his sixty-fourth year. Early in his career Mr. Van Ness served as electrical engineer with Emerson-McMillan Company in a number of cities, subsequently being identified with public utility companies at Lincoln, Neb., and at Memphis, Tenn. He had a wide experience in construction and rehabilitation of electric and gas properties and was considered an expert in analyzing the costs of operation and in conducting rate investigations.

•

PAUL H. JAEHNIG, president of Paul H. Jaehnig, Inc., electrical contractors of Newark, N. J., died December 4, as the result of a stroke. He was 61 years of age. A native of Dresden, Germany, Mr. Jaehnig came to this country at an early age and as a youth worked for the Thomas A. Edison industries. Forty years ago he founded his own electrical business.

•

ANGUS E. MCLEAN, 41, vice-president and general manager of the Bathurst Power & Paper Company, Ltd., and associated as a director with other prominent New Brunswick business enterprises, died in a hospital at Bathurst, N. B., November 17. Mr. McLean was the eldest son of Angus McLean, whose death in January, 1931, left a wide gap in the industrial and financial life of eastern Canada.

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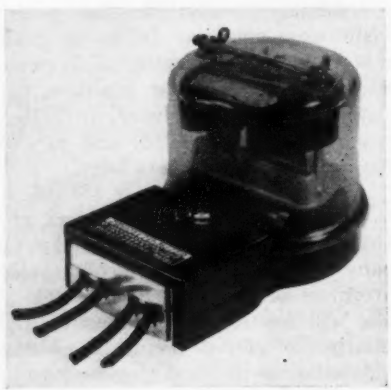
New Equipment Available

Theftproof "Protecto-Meter"

"Protecto-Meter," a device which consists of two blocks of porcelain with channels through them in such a way that the four wires connecting the meter



lay in these channels in a series of bends, has been announced by the Protecto-Meter Manufacturing Company, Davenport, Iowa. A metal cover which goes over the two pieces of porcelain seals them to the meter, making it impossible to get a jumper through to the brass bushings in the meter.

The protecto-meter is theft-proof and can be installed in a few minutes without disconnecting the wires or moving the meter. It gives the same protection on all old open-wire jobs as the new meter trim installations at a small cost.

▼

Fully Automatic Heaters for Electric Forging

Berwick electric forging heaters with three different types of temperature control are announced by the American Car & Foundry Company, New York, in capacities of $\frac{3}{8}$ to $1\frac{1}{8}$ in. The mechanical timing device consists of a reduction-motor-operating-friction disk in which there are holes bored and spaced for any predetermined number of seconds.

The second timing device is the electric definite time relay, which can be set for any number of seconds or minutes. A piece of steel of a given diameter, to be heated to a given length, is inserted between the electrodes. A stop-watch is used and the time is taken to bring it up to the desired temperature. The mechanical timing device or the electric definite time relay is then set for this period of time.

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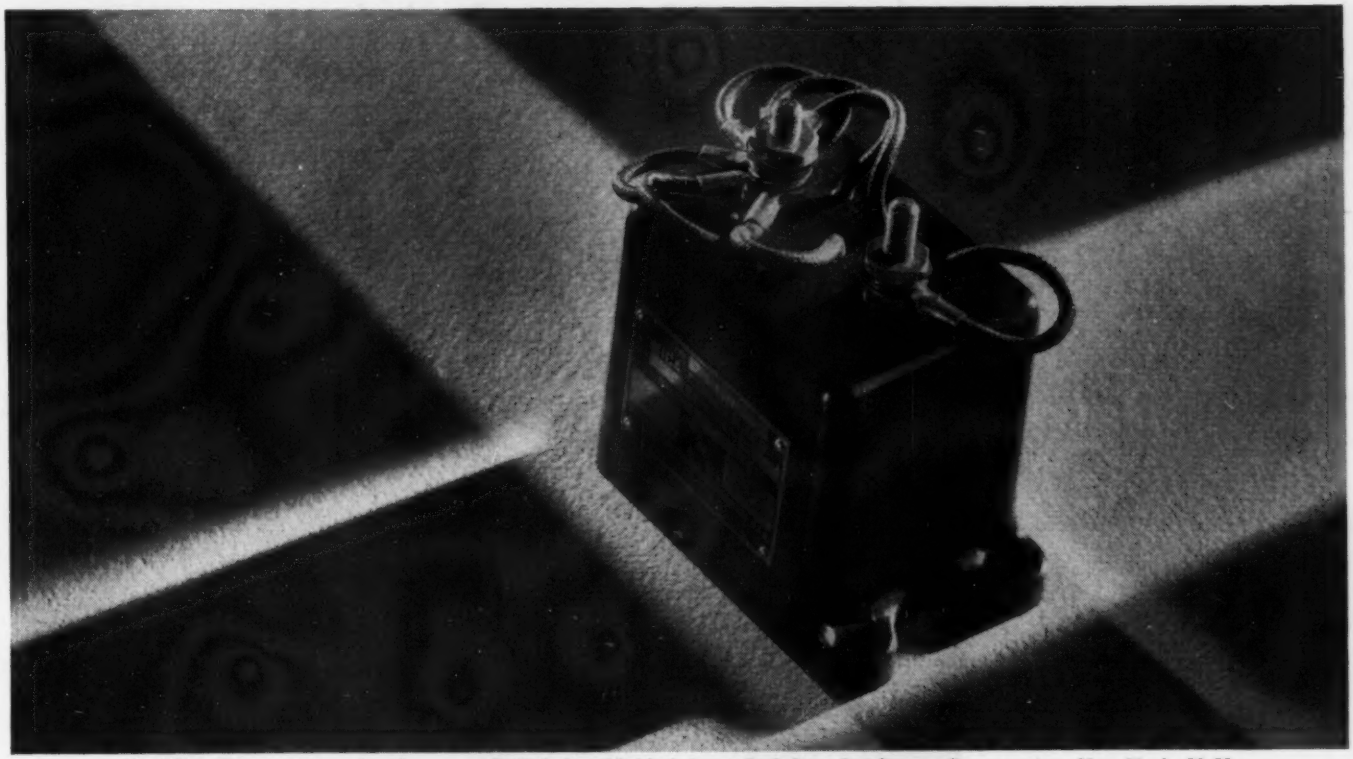

Dubilier Transmitting Condenser with Bakelite Molded Case. Dubilier Condenser Corporation, New York, N. Y.

CAST METAL containers were formerly used for Dubilier transmitting condensers, but recently a large number have been supplied with Bakelite Molded boxes. These condensers have been installed in connection with railway signal apparatus on locomotives, a most severe type of service.

Not only did the Bakelite Molded boxes prove more satisfactory than the metal ones, but the Federal Government, and commercial companies as well, found that the new boxes made possible an increase of over 50 percent in the K.V.A. rating over that of metal encased condensers of the same dimensions. There also was an advantage from a production standpoint, as the Bakelite Molded boxes cost less to make.

Manufacturers of electrical appliances and devices of all types are discovering in Bakelite Molded a means to improved design and appearance and increased sales. Added to the advantage of lasting high insulation value, are the rich colors and permanent lustre of the material. Made in black, brown, and also a variety of attractive colors, Bakelite Molded lends itself to the production of electrical devices of a distinctive character that has real sales value.

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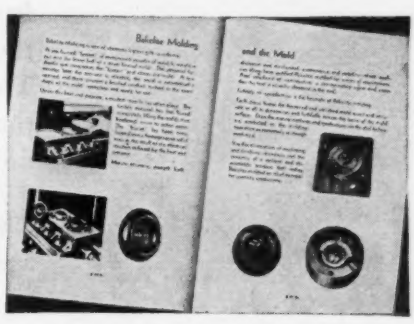

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In the engineering-construction industry resumption of buying has kept the curve of construction and the price curve on the up grade since spring. The weekly average of construction contracts awarded during October was three to five million dollars higher than August and September. This is off-season activity that calls for off-season selling and advertising.

Throughout all industry the untiring efforts of governmental and private agencies are helping to release a huge backlog of orders that has accumu-

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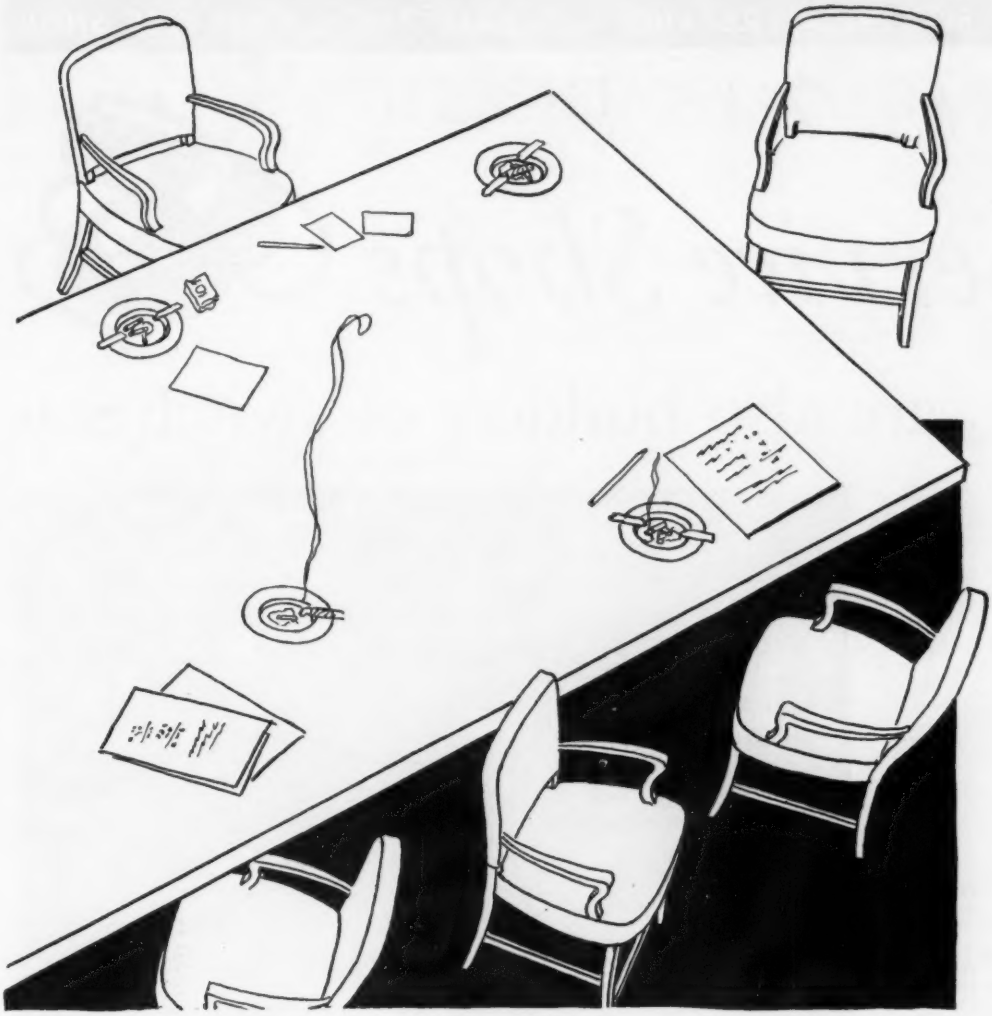

lated through lack of credit and confidence. The influence of RFC financing is being felt by private credit sources which are modifying their restrictions.

All of this means orders. Are you interested enough to make substantial efforts to secure them? Or are you going to let your competitors get them? The various committees and restorative agencies will not, cannot sell specific machinery, equipment and materials. That's your job . . . a job that calls for powerful selling. The job calls for advertising to reach and inform prospective buyers. It calls for salesmen to follow up and close the business.

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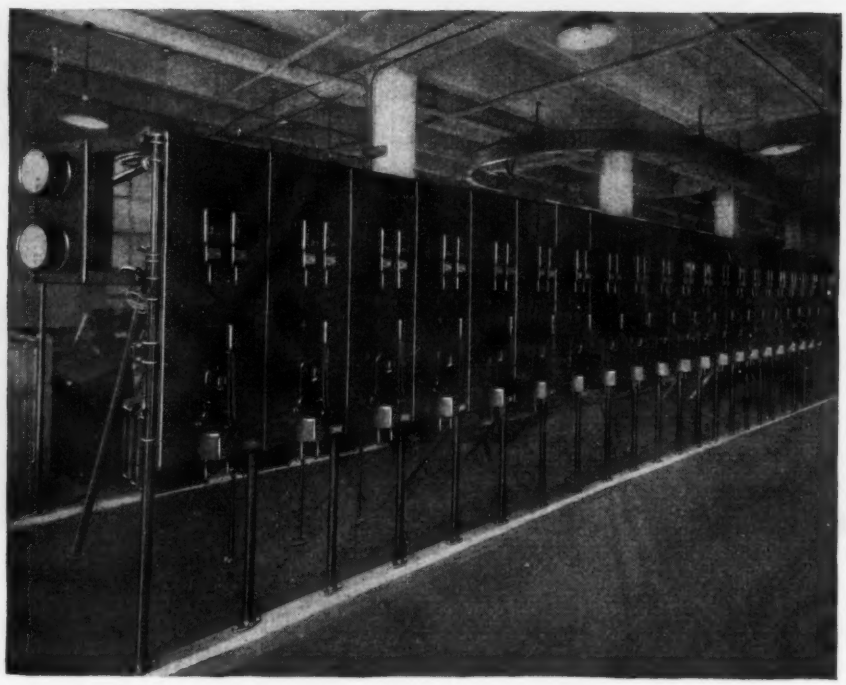

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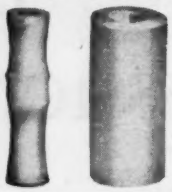

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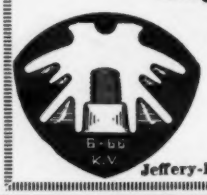

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(Continued on the opposite page)

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TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 20, 1932.—Sealed bids in duplicate subject to the conditions contained herein will be publicly opened in this office at 2 p.m., Jan. 17, 1933, for furnishing all labor and materials and performing all work for furnishing and installing interior lighting fixtures, at the U. S. post office, etc., Beckley, W. Va. Drawings and specifications may be obtained at this office. JAS. A. WETMORE, Acting Supervising Architect. (275)

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TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., Dec. 23, 1932.—Sealed bids in duplicate subject to the conditions contained herein will be publicly opened in this office at 3 p.m., Jan. 20, 1933, for furnishing the materials and performing the work required for installing a complete elevator plant in the main building, etc., U. S. narcotic farm at Lexington, Ky. All prospective bidders are hereby notified that, prior to the award of the contract, the right is reserved by the supervising architect to require any or all bidders to submit a "statement of facts as to qualifications to furnish elevators in strict accordance with the specifications" in detail of such data as may be required including the business and technical organization of the bidder available for the contemplated work, financial resources, building experience, material proposed to be used, etc. The United States expressly reserves the right to reject any bid in which the facts as to business and technical organization, financial resources, or building experience compared with the project bid upon, or materials proposed to be used, justify such rejection. The successful bidder will be required to furnish a performance bond of 50 per cent of the contract price. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act of March 3, 1931 (Public No. 798). Drawings and specifications may be obtained from this office. JAS. A. WETMORE, Acting Supervising Architect. (2710)

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 22, 1932.—Sealed bids in duplicate subject to the conditions contained herein will be publicly opened in this office at 2 p.m., January 19, 1933, for furnishing all labor and materials and performing all work for furnishing and installing interior lighting fixtures, at the U. S. post office, etc., Freeport, N. Y. Drawings and specifications may be obtained at this office. JAS. A. WETMORE, Acting Supervising Architect. (279)

U. S. Government

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 20, 1932.—Sealed bids in duplicate subject to the conditions contained herein will be publicly opened in this office at 2 p.m., January 17, 1933, for furnishing the materials and performing the work required for installing one freight elevator in the U. S. post office at Waltham, Mass. The successful bidder will be required to furnish a performance bond of 50 per cent of the contract price. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act of March 3, 1931 (Public No. 798). Drawings and specifications may be obtained from this office. JAS. A. WETMORE, Acting Supervising Architect. (277)

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 22, 1932.—Sealed bids in duplicate subject to the conditions contained herein will be publicly opened in this office at 2 p.m., January 19, 1933, for furnishing all labor and materials and performing all work for furnishing and installing interior lighting fixtures, at the U. S. post office, court house, etc., Monroe, La. Drawings and specifications may be obtained at this office. JAS. A. WETMORE, Acting Supervising Architect. (278)

(Continued on the opposite page)

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2	100	900	230–2300	3	G.E.
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1	500	900	440/4000	Westghse. syn.
1	500	900	440–2200	G. E. syn.
1	350	900	2200/4000	Wh. syn.
2	300	600	445–2300	G. E. syn.
1	250	600	2200/4000	G. E. syn.
1	250	600	220–440	Westg. syn.
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150	220–440–550	G.E.	600
125	220–440	G.E.	1800
100	550	Westghse.	900
100	2200	Westghse.	900
100	440–220	G.E.	720
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1—112½-kva., 1200-r.p.m., 2300-240-480-V., G.E.
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(Continued from opposite page)

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 22, 1932—Sealed bids in duplicate subject to the conditions contained herein will be publicly opened in this office at 2 p.m., January 19, 1933, for furnishing all labor and materials and performing all work for furnishing and installing interior lighting fixtures, at the U. S. post office, etc., Marshall, Mich. Drawings and specifications may be obtained at this office. JAS. A. WETMORE, Acting Supervising Architect. (271)

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 21, 1932.—Sealed bids in duplicate subject to the conditions contained herein will be publicly opened in this office at 2 p.m., January 18, 1933, for furnishing all labor and materials and performing all work for furnishing and installing interior lighting fixtures, at the U. S. post office, Watertown, S. D. Drawings and specifications may be obtained at this office. JAS. A. WETMORE, Acting Supervising Architect. (272)

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 21, 1932.—Sealed bids in duplicate subject to the conditions contained herein will be publicly opened in this office at 2 p.m., January 18, 1933, for furnishing all labor and materials and performing all work for furnishing and installing interior lighting fixtures at the U. S. post office and court house, Davenport, Iowa. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act of March 3, 1931 (Public No. 798). Drawings and specifications may be obtained at this office. JAS. A. WETMORE, Acting Supervising Architect. (273)

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 21, 1932.—Sealed bids in duplicate subject to the conditions contained herein will be publicly opened in this office at 2 p.m., January 18, 1933, for furnishing all labor and materials and performing all work for furnishing and installing interior lighting fixtures, at the U. S. post office, etc., Rockford, Ill. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act of March 3, 1931 (Public No. 798). Drawings and specifications may be obtained at this office. JAS. A. WETMORE, Acting Supervising Architect. (274)

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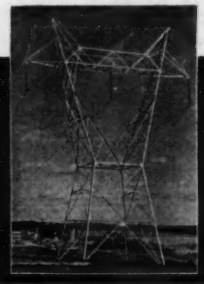

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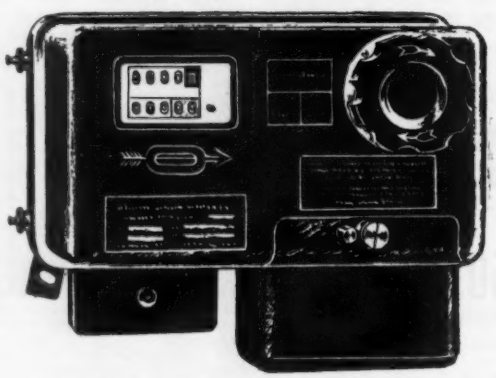

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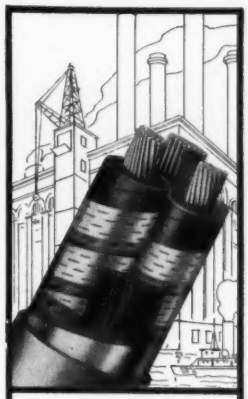

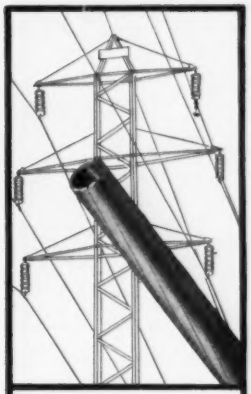

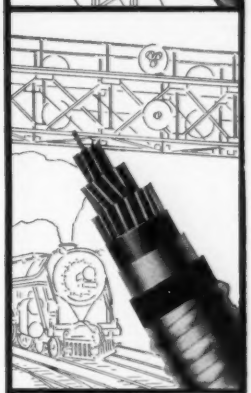

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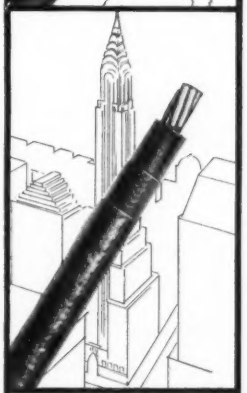

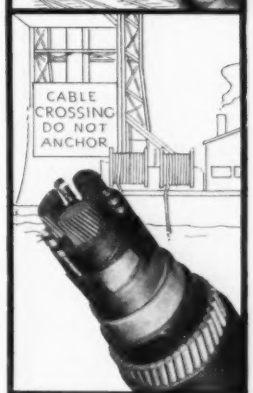

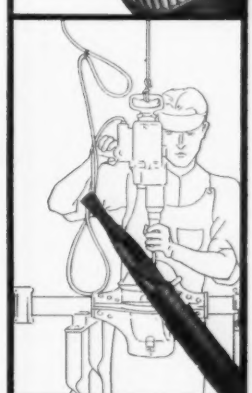

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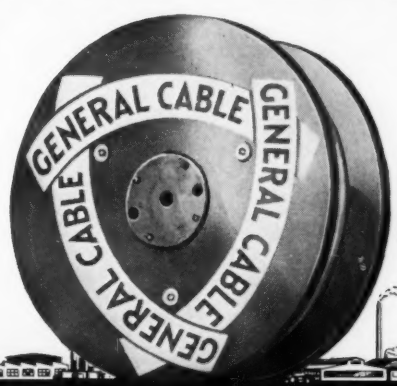

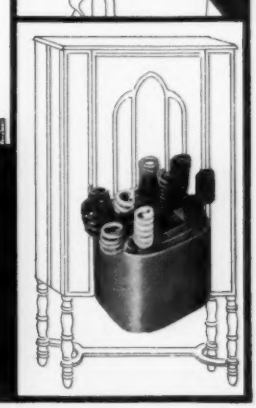

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